SOLICITATION, OFFER AND AWARD

1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)	RATING	PAGE OF PAGES
	N/A	1 | 1

2. CONTRACT NUMBER	3. SOLICITATION NUMBER	4. TYPE OF SOLICITATION	5. DATE ISSUED	6. REQUISITION/PURCHASE NUMBER
	52-DDNR-0-90030	☐ SEALED BID (IFB) ☒ NEGOTIATED (RFP)		NRMAE000000020

7. ISSUED BY CODE WLV:OFA611

U.S. Department of Commerce/NOAA
Acq. Mgt. Division, 1305 East West Highway, Sta 7604
Silver Spring, MD 20910

8. ADDRESS OFFER TO *(If other than Item 7)*

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

SOLICITATION

9. Sealed offers in original and See L.5 copies for furnishing the supplies or services in the Schedule will be received at the place specified in Item 8, or if handcarried, in the depository located in See L.5 until 1500 *(Hour)* local time See L.5 *(Date)*

CAUTION - LATE Submissions, Modifications, and Withdrawals: See Section L, Provision No. 52.214-7 or 52.215-1. All offers are subject to all terms and conditions contained in this solicitation.

10. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE *(NO COLLECT CALLS)* AREA CODE	NUMBER	EXT.	C. E-MAIL ADDRESS
	William L. Voitk	301	713-0839	185	william.voitk@agf.noaa.gov

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OFFER *(Must be fully completed by offeror)*

NOTE: Item 12 does not apply if the solicitation includes the provisions at 52.214-16, Minimum Bid Acceptance Period.

12. In compliance with the above, the undersigned agrees, if this offer is accepted within 120 calendar days *(60 calendar days unless a different period is inserted by the offeror)* from the date for receipt of offers specified above, to furnish any or all items upon which prices are offered at the price set opposite each item, delivered at the designated point(s), within the time specified in the schedule.

13. DISCOUNT FOR PROMPT PAYMENT	10 CALENDAR DAYS (%)	20 CALENDAR DAYS (%)	30 CALENDAR DAYS (%)	CALENDAR DAYS (%)

14. ACKNOWLEDGMENT OF AMENDMENTS *(The offeror acknowledges receipt of amendments to the SOLICITATION for offerors and related documents numbered and dated)*:	AMENDMENT NO.	DATE	AMENDMENT NO.	DATE

15A. NAME AND ADDRESS OF OFFEROR	CODE	FACILITY	16. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*

15B. TELEPHONE NUMBER AREA CODE	NUMBER	EXT.	☐ 15C. CHECK IF REMITTANCE ADDRESS IS DIFFERENT FROM ABOVE - ENTER SUCH ADDRESS IN SCHEDULE.	17. SIGNATURE	18. OFFER DATE

AWARD *(To be completed by Government)*

19. ACCEPTED AS TO ITEMS NUMBERED	20. AMOUNT	21. ACCOUNTING AND APPROPRIATION

22. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION: ☐ 10 U.S.C. 2304(c) ( ) ☐ 41 U.S.C. 253(c) ( )	23. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise*	ITEM

24. ADMINISTERED BY *(If other than Item 7)* CODE	25. PAYMENT WILL BE MADE BY CODE

26. NAME OF CONTRACTING OFFICER *(Type or print)*	27. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*	28. AWARD DATE

IMPORTANT - Award will be made on this Form, or on Standard Form 26, or by other authorized official written notice.

PART I - THE SCHEDULE

SECTION B - SUPPLIES/SERVICES AND PRICE/COSTS

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B.1 SCOPE OF CONTRACT
B.2 CONTRACT LINE ITEM DESCRIPTION LIST

B.1 SCOPE OF CONTRACT

The Contractor shall furnish, as required, the hardware, software, and support services in accordance with Section C, STATEMENT OF NEED, and in conformance with the terms and conditions of this contract. This is a firm-fixed price contract.

B.2 CONTRACT LINE ITEM DESCRIPTION LIST

LOT I

CLIN	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL PRICE
0001	High Performance Computing System In accordance with Section C, Statement of Need for the period October 1, 2000 through September 30, 2001	12	MO		

LOT II, OPTION I

0002	High Performance Computing System In accordance with Section C, Statement of Need for the period October 1, 2001 through September 30, 2002	12	MO		

LOT III, OPTION II

CLIN	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL PRICE
0003	High Performance Computing System In accordance with Section C, Statement of Need for the period October 1, 2002 through September 30, 2003	12	MO		

LOT IV, OPTION III

(CLINs 0004 through 0006 inclusive apply to the option contract period. The Government may exercise this option for the option contract period at any time prior to the expiration of LOT III, OPTION II, CLIN 0003.

0004	High Performance Computing System For the period October 1, 2003 through September 30, 2004	12	MO		

LOT V, OPTION IV

0005	High Performance Computing System For the period October 1, 2004 through September 30, 2005	12	MO		

LOT VI, OPTION V

0006	High Performance Computing System For the period October 1, 2005 through September 30, 2006	12	MO		

LOT VII, OPTION VI

0007	Option to increase processors to a minimum of 512MB of main memory	01	LT		

LOT VIII, OPTION VII

0008	Option to increase processors to a minimum of 1GB of main memory	01	LT		

NOTES TO OFFERORS:

NOTE A - Offerors are required to submit cost/price proposals based upon the following funding profile:

Base Contract Period		
FY 2000	-	$ 2.95 million
FY 2001	-	$ 9.45 million
FY 2002	-	$10.9 million
FY 2003	-	$10.9 million
Base Contract Total		$34.2 million
Option Contract Period		
FY 2004	-	$10.9 million
FY 2005	-	$10.9 million
FY 2006	-	$10.9 million
Option Contract Total		$32.7 million

NOTE B - Offerors shall include with their price proposal, the interest rate used in calculating lease costs of equipment.

NOTE C - Section J.4, PRICING TABLES AND EXHIBITS, provides numerous pricing tables that must be completed and submitted with your price proposal. Offerors are required to complete all of the following Tables, regardless of the acquisition method proposed:

Table A-1, Detailed Hardware/Software Cost Table
Table A-1M, Detailed Hardware/Software Maintenance Cost Table
Table A-2, Detailed Additional Items cost Table
Table A-4, Additional Items Cost Table by Month
Table A-5, Power, Cooling, and Floor Space Cost Table

Pricing Tables are provided for various acquisition methods (e.g., LTOP, LWOP, Lease, etc.) Offerors are required to complete the Pricing Tables for only those methods of acquisition that are being proposed. For example, if an offeror is only proposing a lease method, the offeror is required to complete the following Tables :

Table A-3.1, Lease Plan

NOTE D - Offerors shall propose separate pricing for each year.

NOTE E - **The Government anticipates leasing the equipment during the system life (both base contract period and option contract period). However, the Government requires ownership of the Hierarchical Storage Management System (HSMS) at the end of the base contract period (September 30, 2003).**

NOTE F - Section L contains the clause INVITATION TO PROPOSE FINANCING TERMS (FAR 52.232-31)(OCT 1995). For evaluation purposes, assume the following:

(1) Evaluation of financing proposals will be based upon October 1, 1999, as the first invoice payment and will continue for sixty (60) months. If monthly prices are adjusted because of system upgrade(s), offerors need to specify the month the adjustment occurs and the amount.

(2) In accordance with Federal Acquisition Regulation 32.205(c)(4) the time value of proposal specified contract financing arrangements shall be calculated using an interest rate of 5.9% as specified in Appendix C to Office of Management and Budget (OMB) Circular No. A-94, “Benefit-Cost Analysis of Federal Programs; Guidelines and Discounts.”

NOTE G - In preparing the cost proposal, Offerors should keep in mind that only 94% of the funds available annually, beginning in FY 2001, may be dedicated to the HPCS components, as indicated in Section C.2.

C. Statement of Need

C.1 Background and Purpose

The Geophysical Fluid Dynamics Laboratory (GFDL), located on Princeton University's Forrestal Campus, Plainsboro, NJ, is a federal research laboratory in the Office of Oceanic and Atmospheric Research (OAR) of the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce (DOC). GFDL performs comprehensive, long lead-time research that is fundamental to the mission of NOAA. The goal of this research is to expand the scientific understanding of the physical processes that govern the behavior of the atmosphere and the oceans as complex fluid systems. These systems can then be modeled mathematically and their phenomenology can be studied by complex computer simulations. To help achieve this goal, GFDL proposes to enhance its computing capabilities by acquiring a balanced high-performance computing system (HPCS). The HPCS must provide a complete high-performance computing environment, including very large scalable computing and archiving capacity, and analysis, visualization, networking, and telecommunications capabilities. This enhanced computational capability will replace GFDL's current T932 and T3E supercomputers leased from SGI/Cray Research and will provide all of the facilities required by GFDL to carry out its computational research.

Increased computational power is essential for GFDL to make progress in solving some of the very difficult problems confronting the climate and weather research community and to support on-going and developing research collaborations within NOAA and with other government agencies. The sharp increase in computing, archival, and analysis capabilities provided by the HPCS acquisition will allow NOAA to most effectively use the scientific talent at GFDL to attack some of the critical problems that currently inhibit progress in decadal-centennial climate projections, seasonal-interannual climate predictions, and the development of the next-generation hurricane prediction system.

This procurement has clearly defined goals from the NOAA IT^2 budget initiative document, entitled "Attacking Frontier Challenges in Climate and Weather Modeling". The research drivers that are the focus of this initiative involve the very leading edge of research activities in climate and weather and address the following four scientific objectives:

- Develop a more realistic model representation of cloud-radiative feedback. This will result in improved regional projections of climate change that will help the broader research community determine the impacts of this change as part of the U.S. climate research program and the IPCC climate change assessment in 2005.

- Identify and evaluate sources of climate "drift" in long-running, higher resolution, coupled climate models, including investigation of the effects of the deep ocean circulation on model behavior.

- Develop the next-generation GFDL coupled research model using more realistic physics, higher resolution, and full ocean-atmosphere-soil coupling and evaluate its skill for seasonal-interannual climate prediction and its capability for elucidating the processes controlling El-Niño-Southern-Oscillation events.

- Develop a more advanced GFDL Hurricane Prediction System to further improve track forecasting accuracy and to provide improved prediction of wind and precipitation fields, storm surge, and changes in storm intensity.

As discussed in the budget initiative document, each of these areas provides potentially enormous benefits to the Nation in terms of reduced costs resulting from improved hurricane predictions, value to agriculture arising from improved seasonal forecasts and interannual climate predictions, and critical value for the Nation through a reduction in uncertainty about global climate change.

In order to fulfill the objective of acquiring the HPCS in FY2000, the Government will utilize the Department of Commerce's re-engineered acquisition process referred to as Concept of Operations or CONOPS, described in "Department of Commerce Acquisition Process Case for Change" (http://oamweb.osec.doc.gov/conops). The intent of the new process is to create an improved acquisition environment that will benefit the Contractor and the Government. In order to successfully implement this new process within this acquisition, the Government seeks the cooperation of the vendor community in an effort to conduct business in an atmosphere of integrity, openness, and fairness. It is essential that the Government acquire the best HPCS available for the budgeted level of funding and do so in an expedient and fair manner.

This Statement of Need establishes the purpose, objectives, and the expected results for the HPCS procurement. The contract to be awarded will provide for multiple computer systems and ancillary equipment. The contract will also provide for maintenance and support services.

Definitions of terms used in this Statement of Need may be found in section C.6.

C.2 Procurement Objective

The primary objective of this acquisition is to acquire balanced, comprehensive computing capabilities for GFDL. This includes not only high-performance computing but also corresponding capabilities for data management and archiving, analysis and visualization of model results, and networking and telecommunications that the Laboratory needs to most effectively advance its research programs.

The key to effective use of the HPCS is balance. Each component of the HPCS plays a critical role in maintaining the flow of information through GFDL's model simulations, analyses, visualizations, and ultimately into scientific insight and the dissemination of

knowledge to the research community and the other customers of the Laboratory's research. Consequently, the functional capability of the large-scale computers, hierarchical storage management system, analysis and visualization platforms, desktop workstations, and network bandwidth must be well-matched in a way that minimizes bottlenecks to the flow of information while maximizing performance. Achieving this proportionality in the acquired capabilities is an essential goal of this procurement.

Additionally, the computational resources available to GFDL must balance its scientific needs throughout the life of the contract, so the Government requires a phased delivery of all components of the HPCS. The initial delivery of the HPCS must provide a substantial increase over current capabilities in computational throughput for the Laboratory. At least one substantial upgrade to the sustained throughput must be offered during the base contract period, with archiving and other HPCS capabilities increasing commensurately. The individual components of the HPCS need not be upgraded simultaneously, but balanced performance at all times is desired and will be evaluated by the Government.

The period covered under the Project Agreement, FY2000-FY2006, will be divided into a base contract period (FY2000-2003), followed by an option period (FY2004-2006). During the base contract period, the contract will be renewed each year subject to the availability of funds. The decision to exercise the option in FY2004 will be made by evaluating a proposal, submitted by the incumbent Contractor at the end of FY2002, that provides detailed specifications for the HPCS during the option period. If the option is exercised, the contract will be renewed each year subject to the availability of funds. The final year of HPCS operations (FY2006) will overlap with the acquisition and acceptance of successor computational capabilities.

No less than 94% of the annual funding, beginning in FY 2001, will be dedicated to the components of the HPCS specified in this RFP. Under direction from the Government, the remaining funds will be used by the Contractor to refine key areas of the HPCS, or other aspects of GFDL’s computing environment covered under the scope of the contract, that will improve performance, efficiency, or usability of the overall system. These areas may include, but will not be limited to, node, disk, or memory upgrades, visualization, server, and desktop capabilities and the supporting network infrastructure, and additional support. Key areas will be identified on an as-needed basis by performance assessments, including an annual system performance review by the Government. The Government and the HPCS Contractor will work together to identify the necessary items that will best meet GFDL's computing needs. Actual purchases for this purpose will be determined solely by the Government.

Since computing is essential to GFDL's scientific objectives, the HPCS must be characterized by a very high level of reliability and availability. System availability of at least 96% (24 hours/day, 7 days/week) has been the historical goal for GFDL's high-performance computers, and this level of availability must be met by each component of the HPCS.

The final budget for the HPCS procurement has not been finalized, although the targeted total funding level stated in this solicitation is approximately $67 million during FY2000-06 and is estimated to be no more than $81 million. The Government expects that any increases over the targeted funding profile will be used to increase the HPCS computational throughput and other resources needed to provide a balanced system approximately in proportion to the increase in funding.

It is desired that the initial HPCS be available for Contractor testing and preparation for the pre-acceptance Live Test Demonstration (LTD) by December 2000. The HPCS and the associated support staff will be located in the GFDL buildings on the Forrestal Campus of Princeton University in Plainsboro, NJ.

The basic tenets and provisions of this Statement of Need establish what the Government feels are the minimum acceptable capabilities of the HPCS based on GFDL's long-time experience in performing its mission. However, innovation in proposed high performance solutions is encouraged in addressing the needs of the Government. Newer technologies or an approach different from that presented here may provide opportunities to increase performance or enhance efficiency.

C.3 Current Computing Environment

C.3.1 High-performance computing platforms

The key components in GFDL's current computing environment are a Cray T932 shared-memory vector supercomputer with 22 vector processors, a Cray T94 shared-memory vector supercomputer with 4 vector processors, and a scalable, distributed-memory Cray T3E with 128 application processors. A very large data archive is hosted by the T94, the contents of which can also be accessed from the T932, the T3E, and desktop workstations. High-speed interconnections allow very fast data transfers between elements of the central computing facility. The T932, T94, and T3E have similar UNIX operating systems and software development environments, and they all use IEEE 64-bit precision arithmetic. The FORTRAN 90 programming language and parallel code development software is available on all of these systems. The entire computing environment operates 24 hours a day, 365 days a year. Typical operational use time is in excess of 22 hours per day on the T932, 23 hours per day on the T94, and over 23.5 hours per day on the T3E.

Most of the model runs that require significant computing resources are executed on the T932, which has 4 GB of main memory, 32 GB of secondary data storage (SDS) which is used primarily as secondary memory, and 447 GB of disk storage. Approximately 30 production runs typically execute concurrently on the T932. The production runs consist primarily of a sequence of unitasked jobs (although scientists have also developed several multitasked production applications as well) that resubmit themselves; this sequence may run for months at a time. Typically, each job within a production run will request data from

the archive hosted on the T94, transfer it to temporary disk storage on the T932, execute, then transfer output back to the data archive. Memory- and I/O-intensive postprocessing and analysis of this data is usually carried out on the T94, which has 1 GB of main memory, a 4 GB solid state storage device, and 760 GB of disk storage distributed primarily between temporary disk storage and staging disk for data in the tape archive. The T94 also runs approximately 6 concurrent production jobs at night. GFDL has found that dedicating the T932 and T94 resources in this way substantially enhances the efficiency at which these two machines run. Each T90 vector processor sustains an average of about 450 MFLOPS on GFDL's total production workload, so together both T90s provide approximately 12 GFLOPS for these computational tasks.

The T3E has 256 MB of memory on each of its 128 application processors and about 370 GB of disk storage used primarily as scratch space. The T3E’s greatest value is as a development machine in the present computing environment. Users currently employ the T3E to parallelize unitasked codes and port multitasked codes from the shared-memory environment on the T90s to a distributed-memory environment. The T3E's success in this role is evidenced by the 2-4 production jobs that run concurrently on this machine, in a manner similar to that on the T932. The T3E provides about 4 GFLOPS of peak throughput for parallelized production codes.

C.3.2 Batch queuing, scheduling, and accounting

Each group at GFDL is assigned a monthly allocation of T90 CPU hours for batch work. By default, batch jobs are submitted to "allocated" queues. Once a group's monthly allocation has been used, all batch jobs submitted by that group are forcibly directed to windfall queues. Windfall jobs are run during non-primetime hours (7pm-7am) or when there is not enough allocated work to fully utilize the system.

CPU accounting runs once per day, which limits the granularity for enforcing the monthly allocations. Allocated batch, windfall batch, and interactive CPU time for each group are distinguished using the UNICOS account id feature. The monthly CPU allocation scheme is implemented by a locally-developed wrapper for the NQS qsub command.

Table 1. Queue Resource Limits on T932 / T94

QUEUE	NICE	Max CPU (sec)	MEM (MW)	SDS (MW)
ashot	30	1200	16	64
asbig	30	2400	48	256
aprod	35	32400	48	256
novel	35	129600 / 43200	256 / 96	1792 / 360
wshot	37	1200	16	64

Table 1. Queue Resource Limits on T932 / T94				
wprod	38	32400	48	256

In Table 1, queues starting with the letter "a" are allocated queues, and queues starting with the letter "w" are windfall queues. There is also a "novel" queue that is reserved for jobs with special resource requirements. Resource limits that differ on the T932 and T94 are separated by a “/”.

To encourage parallelization of GFDL's model codes, monthly CPU allocations are currently not implemented on the T3E.

C.3.3 Disk I/O

The I/O in GFDL's production runs is typically dominated by reading a restart file at the beginning of a run, writing many snapshots of geophysical variables throughout the run (history files), and writing restart data at the end of the run. These runs also write to the standard FORTRAN output units. A restart file is usually a single large binary file, while the history files can be either one large file or many small files (for example, one file written per CPU, typically in netCDF format, on the T3E) that can be merged into a single large netCDF file after the production run finishes. The I/O to large restart files and the efficient creation of many small files on the LSC disk used for temporary storage, as well as the ability of the HSMS (see below) to archive many small files simultaneously, are among GFDL's principal concerns. The following table summarizes current disk performance on all three supercomputers:

Table 2. Disk Performance Summary			
Platform	***RAID-3 Drives / Channels***	***JBOD Drives / Channels***	***Maximum Total Bandwidth***
T932	10 / 10	237 / 41	~750 MB/sec
T94	19 / 19 Fibre	6 / 1 Fibre	~900 MB/sec
T3E	6 / 6 Fibre	0 Fibre	~300 MB/sec

C.3.4 Data archive

Centralized data archiving is presently provided by the Cray T94 using the UNICOS Data Migration Facility (DMF). About 500 GB of archive staging disk is hosted by the T94. Two StorageTek (STK) Powderhorn silos contain 8 STK Timberline and 4 STK Redwood tape transports and a library of approximately 6000 IBM 3490E-compatible Timberline tapes (800 MB each), 1100 Redwood tapes (10 GB each), and 2500 Redwood tapes (50 GB each); there are expected to be approximately 1900 free cells in the STK silos at the end of the current contract. Each STK tape transport includes an integrated IBM-compatible ESCON controller. The tape transports provide an aggregate transfer rate of about 88 MB/s between the tape library and the staging disk. Operation of GFDL's computing environment presently requires an average of over 2400 tape mounts per day. During intermittent periods of high activity, up to 350 tape mounts per hour are required, which roughly corresponds to the maximum tape mount rate available with the 8 Timberline tape transports. A data compression factor of about 1.3x is approximately balanced by a tape fill factor of about 70% to achieve storage at nearly the rated tape capacity.

The number and capacity of files in GFDL's data archive, as a function of file size, are shown in Figure 2, in which the blue curve with squares represents cumulative totals of the number of files (left-hand plot) and KB (right-hand plot) in the archive, and the red curves with diamonds represent increments to these quantities for each file size bin.

Note that about 30 TB out of the entire ~100 TB archive is contained in files that are between 200 and 500 MB in size. However, over three-fourths of the number of files in the archive are less than 100MB in size. The following table of daily average tape mount statistics from 1999 shows that about four-fifths of tape mounts are to read and write files less than 80MB in size, indicating that frequent access to files of smaller size is as crucial to GFDL's scientific workload as fast access to files of larger size.

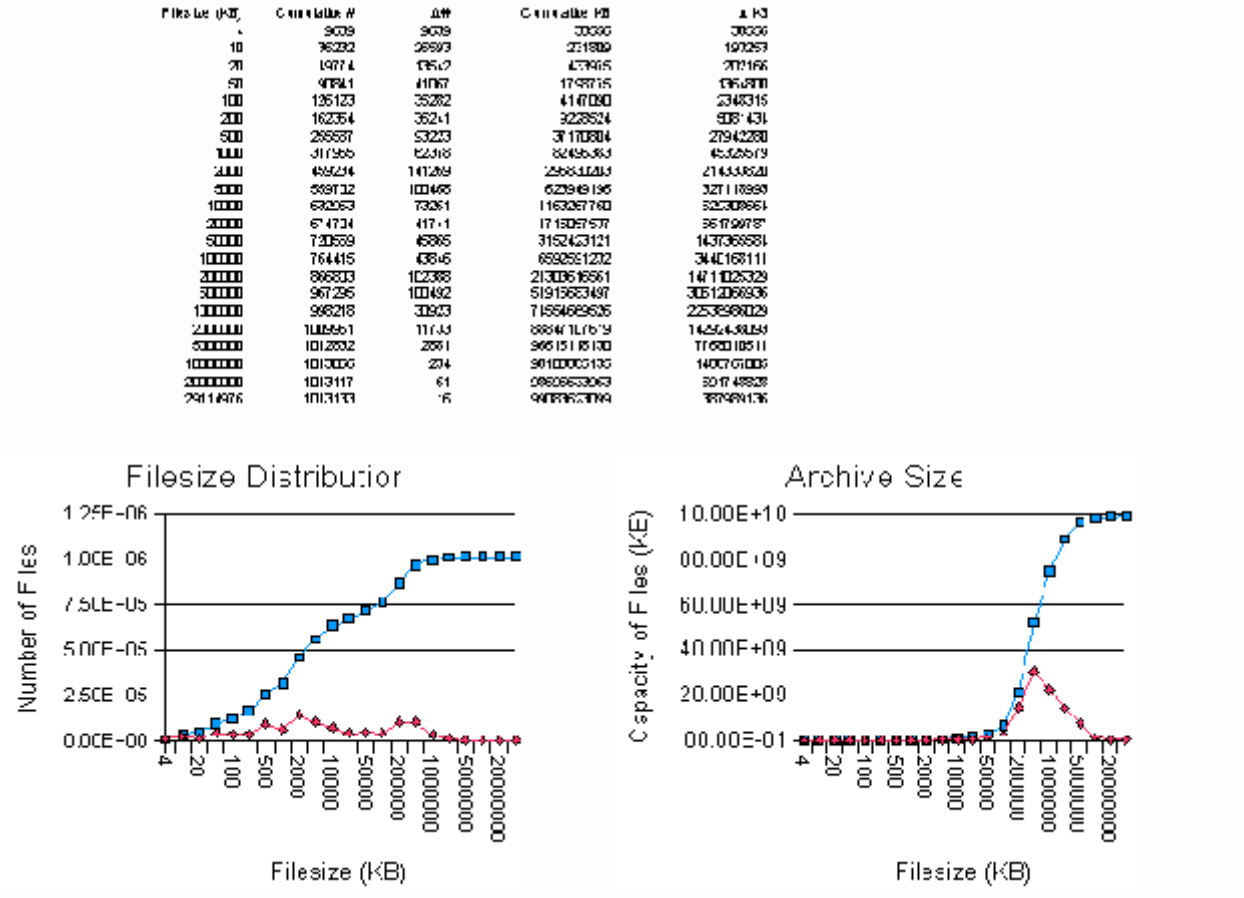


Figure 1. Number of files and capacity of files as a function of file size

Table 3. Daily Average Tape Mount Statistics					
File size	***Files Mounted***	***MB Mounted***	***Mounts***	***Files/Mount***	***MB/Mount***
< 80 MB	14898	107146	1280	11.64	83.70
80-160 MB	330	33874	100	3.30	338.74
> 160 MB	510	259080	244	2.09	1061.8

Files less than 80 MB in size are archived to Timberline tapes, files between 80 and 160 MB are archived to 10GB Redwood tapes, and files greater than 160 MB in size are archived to 50GB Redwood tapes; these categories correspond to the rows in the table. Because of the limited number of Timberline tapes available in the current archive, users typically collect many small files (those less than 80MB in size) into a cpio or tar file that is archived on Redwood tapes.

All of GFDL's supercomputers and desktop workstations have access to the entire data archive. The data archive appears as a single directory (/archive) to users on the T90s and workstations. This directory is hosted on the T94. On the T932, read/write access to this

directory is provided via NFS, and locally developed scripts employ the rcp command to enhance performance on file transfers. On the T3E, file transfers between /archive and local temporary disk are accomplished with the rcp command. On the workstations, read-only access is provided via NFS.

Presently about 100 TB of data are archived, and the growth rate of the archive has averaged 2.5 TB/month over the last year. The archived data includes restart files, boundary conditions, and initial conditions required to run GFDL's models, history data and analysis files from model runs, datasets for model comparison, and archived source code. Most data is archived in 32-bit IEEE floating-point format in big-endian byte order, which allows the data to be read directly by GFDL's desktop workstations. Restart files are usually stored in 64-bit format in a binary file. There are also files stored in Cray-proprietary COS-blocked format, and cpio files that have Cray binary headers.

Files used for model analysis are written once and read many times, accessed repeatedly over periods ranging from several days to years. Individual users are permitted to stage up to 50 GB of archived files to disk at any given time. The amount of archived data read and written per day is greater than the size of the staging disk space, so in addition to user-directed migration, files are automatically migrated from staging disk to tape when the available space on this disk becomes low.

C.3.5 Desktop workstations

Distributed throughout GFDL are over 110 desktop workstations, mostly Personal Irises, Indigos, and Indigo-2s manufactured by SGI. Most of the workstations are located in scientists' offices; the rest are in public areas. Supporting these workstations are 4 SGI and 2 Sun servers plus a variety of Postscript printers. These workstations are used for data analysis and visualization, as well as day-to-day office tasks such as email and manuscript preparation.

C.3.6 Network configuration

GFDL's current network configuration is discussed in its Computer Users Guide (available by request). Point-to-point HIPPI interconnections at 100 MB/s and 200 MB/s provide fast data transfers between the Cray supercomputers, which are also connected to a computer-room FDDI ring. The facility-wide workstation network is comprised of several 10/100 Mb/s switched Ethernet hubs connected to a Gigabit Ethernet (GBE) switch/router in the computer room. One of the switched Ethernet hubs is connected to the FDDI ring, providing interactive access to the supercomputers from the workstations. Access to the Internet is via a 1.5 Mb/s T-1 communications link to an Internet access provider. There is also a 10 Mb/s connection to the Princeton University network. External information exchange is accomplished using FTP and the World Wide Web; very large data sets are exchanged using 8 mm magnetic tape.

C.3.7 Directory Trees

There are several principal directory trees in use at GFDL. The entire data archive appears as a single /archive directory to the users. Workstation home directories (/home)

on a central server can be accessed from any workstation. Separate home directories for the T90s (/t90) are hosted by the T94 and served to the T932 and all workstations. The T3E has its own home directories (/t3e) which are available to the workstations. Temporary directories unique to each interactive session or batch job provide workspace for users on each supercomputer.

All of these computing resources are currently shared by about 100 users at GFDL and nearly 50 other collaborators worldwide. Additional information on GFDL's current computing environment can be found in GFDL's Computer Users' Guide and in GFDL's IT Architecture document (http://www.gfdl.gov/~jps/noaa_hpc/GFDL_IT-Arch.ver1.html).

C.3.8 Government-Furnished Equipment

Government-furnished equipment includes the two STK Powderhorn silos, the 8 STK Timberline and 4 STK Redwood tape transports (including integrated IBM ESCON controllers), and the IBM ESCON director. Two GBE interfaces on GFDL's GBE backbone have been reserved to connect to the HPCS.

C.4 Specifications

C.4.1 Overview

The Government requires a single Contractor to be responsible for the design, installation, maintenance, and support of a high-performance computing system (HPCS) at the GFDL in Plainsboro, New Jersey. The HPCS shall meet the stated objectives and specifications set forth in this Statement of Need and shall include all hardware and software necessary to operate the HPCS as a complete, functional, balanced, and highly reliable system. A single Contractor will serve as the point-of-contact for the entire HPCS, even though the HPCS may involve separate subsystems from a number of different vendors.

Fundamentally, the Government must improve its computing capacity and performance in all aspects of GFDL’s computing environment in order to fulfill its mission. These aspects include:

- High-performance computing, including large scale computing and analysis capability. Large scale computing is currently supplied by the Cray T932 and T3E, and to some extent by the T94. The HPCS shall include a Large Scale Cluster (LSC) that provides scalable supercomputing capabilities to support GFDL's leading-edge research in geophysical fluid modeling. Analysis capability is currently supplied by the T94 and desktop workstations. The HPCS shall include an Analysis Cluster (AC) that provides efficient execution of I/O-intensive FORTRAN codes and third-party software, which are required to analyze and interpret model output produced by the LSC.
- A Hierarchical Storage Management System (HSMS), currently supplied by DMF running on the T94 in conjunction with the STK Powderhorn tape libraries and the T94 /archive filesystem. The HSMS shall provide archiving capacity to meet the expected rates of data production on the LSC and AC.

- Shared HPCS resources. A /home directory file server (HFS) shall provide the home directory at login for all computers and workstations at GFDL. High-speed connectivity, currently supplied by the HIPPI connections between the Cray supercomputers and the FDDI, shall provide communication between the LSC, AC, HSMS, and workstations.
- Software for resource management, system administration, and application development. The Government requires operating systems and cluster software that can manage resources on the LSC, AC, HSMS, and HFS. Complete and functional FORTRAN90, C, and C++ application development environments shall also be provided.
- Reliability, availability, and support. The HPCS must continue GFDL's historically high utilization of its computing resources. System reliability, availability, and Contractor support are considered fundamental aspects of the HPCS and are an important aspect of the evaluation of any proposed HPCS.

The initial delivery of the HPCS will be installed and operated in parallel with the full existing SGI/Cray configuration. Operation of the HPCS shall have no negative impact on the performance or availability of the Government's existing equipment. The Government's intent is to continue the lease and maintenance of the currently-configured T932 and T3E systems and associated equipment until thirty days after the Government's acceptance of the new system or December 31, 2000, whichever date is later. SGI/Cray Research will remove this equipment from the premises within thirty days after the end of the lease. Ownership of the T94 will transfer to the Government in October 2000. SGI/Cray will provide maintenance of this equipment under an extended warranty through September 30, 2001.

If the Contractor is unable to successfully complete acceptance of the Initial System thirty days prior to December 31, 2000, the Contractor will be liable for liquidated damages as specified in Section H.15, LIQUIDATED DAMAGES. SGI/Cray has informed the Government that it will only support the T932/T3E systems through March 31, 2001. If the Government does not accept the Initial System thirty days prior to this date, the Contractor shall provide the GFDL users with access to computational and archival storage resources that are at least equivalent to the computing environment of the T932 and T3E systems. This should be done in a manner that will allow GFDL users to continue their computational research without interruption or degradation, beginning April 1, 2001.

C.4.2 Requirements

The proposed HPCS shall meet or exceed the following requirements:

C.4.2.1 Large Scale Cluster (LSC)

! An LSC of two or more computers

- Completion of the LSC throughput benchmark in no more than 14400 seconds of wallclock time on the initial delivery of the LSC, configured as it will be run in production at GFDL
- At least one substantial upgrade to the sustained throughput of the LSC, as measured by an LSC throughput benchmark, during the base contract period
- Options to further enhance the LSC throughput after the base contract period
- A minimum of 144 GB of total memory on the initial delivery of the LSC
- A minimum of 256 MB/processor
- Options for at least 512 MB/processor and 1 GB/processor of memory
- A minimum of 3 dTB of formatted disk, exclusive of system , residing on a fault-tolerant disk subsystem
- A minimum sustained total I/O bandwidth to this disk of 4 GB/sec
- The ability to store files of up to 100 GB in size on this disk
- The ability to read file formats written by the AC without explicit library calls for data conversion from within the application.
- Failover capability for job queuing and scheduling

  When any set of resources in the LSC fails,

  - batch jobs using those resources are rerun without user intervention
  - only interactive sessions hosted on the failed resources are lost
  - users must continue to be able to login interactively
- The capability of running at least two copies of the Government's projected largest when any single computer is unavailable for user jobs
- The capability of the LSC to operate and be repaired in degraded mode
- Full functionality when any part of the AC is halted or powered off
- An availability level of 96% on every computer in the LSC

C.4.2.2 Analysis Cluster (AC)

- An AC of two or more computers
- At least one substantial upgrade to the sustained throughput of the AC, as measured by an AC throughput benchmark, during the base contract period
- At the end of September 2001, assumption of the T94's maintenance payments or replacement of the T94 with an upgrade to the AC that provides computational performance at least equivalent to the T94, as measured by an AC throughput benchmark
- De-installation and disposal of the T94 if it is replaced

- Options to further enhance the AC throughput after the base contract period
- A logically-shared address space, at least 32 GB in size, on all computational nodes of the AC
- A minimum of 64 GB of total memory available for user processes on the AC
- The ability to increase total memory on the AC by increasing the memory on each node or by replacing nodes with ones having larger memory capacities
- At least 5 dTB of formatted disk, exclusive of disk used for system use, residing on a fault-tolerant disk subsystem
- A minimum sustained aggregate I/O bandwidth to this disk of 6 GB/sec
- The ability to store files of up to 100 GB in size on this disk
- The ability to read file formats written by the LSC without explicit library calls for data conversion from within the application
- Failover capability for job queuing and scheduling

  When any set of resources in the LSC fails,

  - batch jobs using those resources are rerun without user intervention
  - only interactive sessions hosted on the failed resources are lost
  - users must continue to be able to login interactively
- The capability of the AC to operate and be repaired in degraded mode
- Full functionality when any part of the LSC is halted or powered off
- An availability level of 96% on every computer in the AC

C.4.2.3 Hierarchical Storage Management System (HSMS)

- All disk required for caching or staging of files within the HSMS must be fault-tolerant and in addition to the required LSC and AC disk
- A data recovery service provided by the Contractor in the event of nearline or offline media failure
- Presentation of the data archive to the users as a single /archive filesystem image
- All storage media used in the HSMS is provided by the Contractor, including any new media used in the legacy archive but excluding the Timberline and Redwood tapes in the legacy archive at the time of HPCS installation
- Government ownership of the HSMS at the end of FY2003
- An HSMS benchmark, run concurrently with the AC throughput benchmark, that completes on the proposed HSMS in no more than 3600 seconds of wallclock time
- Availability of offline storage beginning in October 2001

- A nearline tier capacity of at least 1000 dTB of data, independent of compression and at the tape blocksize used by the proposed HSMS, by the end of FY2003
- An offline tier capacity of at least 1000 dTB of data, independent of compression and at the tape blocksize used by the proposed HSMS, by the end of FY2003
- Assuming the optional contract period is exercised, a minimum final total capacity for nearline and offline tiers of 5000 dTB of data, independent of compression and at the tape blocksize used by the proposed HSMS, by the end of FY2006
- The ability to store a minimum of 10,000,000 archived files
- The ability to store files of up to 100 GB in size
- A minimum 10 dMB/s sustained single-file transfer rate from nearline storage to disk , independent of compression and at the tape blocksize used by the proposed HSMS
- A minimum 160 dMB/s aggregate sustained transfer rate between disk and nearline media for access to small frequently-used files, independent of compression and at the tape blocksize used by the proposed HSMS
- A minimum 200 dMB/s aggregate sustained transfer rate between disk and nearline media for access to large files, independent of compression and at the tape blocksize used by the proposed HSMS
- A minimum aggregate tape positioning rate of 1200 mounts per hour for access to small frequently-used files
- At least one substantial upgrade in the aggregate sustained transfer rate between disk and nearline media during the base contract period
- If disk is required for caching or staging of files within the HSMS, a commensurate upgrade to the capacity of this disk
- HSMS software that provides automatic migration between data archive tiers based on a combination of access time and file size
- The availability of the /archive filesystem image on the LSC and AC via a protocol such as NFS v.3 or DCE/DFS, or as a shared filesystem
- A high-performance file transfer interface, such as the UNIX rcp, on the LSC and AC
- NFS v.3
- The availability of the /archive filesystem image with read/write access on the T932, T94, T3E, and user workstations via NFS v.2 and the UNIX rcp command
- Failover capability in the server that manages the data archive
- An availability level of 99.96% for the data archive
- Failover to backup resources complete within 300 seconds

- All of the data residing in GFDL's DMF data archive readable by desktop workstations throughout the base contract period
- The legacy archive readable and writable by the T94, T932, and T3E until these systems are de-installed
- A legacy archive benchmark reading files from the legacy archive that completes in no more than 1800 seconds throughout the life of the legacy archive

  If the T94 is used to serve the legacy archive

  - Contractor provided system administration for the T94, including DMF, after the current contract expires at the end of October 2000
  - LSC and AC access to the legacy archive via a high-performance HIPPI or FDDI interface to the T94
- If the T94 is still in use to serve the legacy archive at the expiration of it's warranty at the end of September 2001, Contractor assumption of its hardware maintenance payments

  If the T94 is not used to serve the legacy archive

  - Functionally equivalent access to the legacy archive
  - T932 and T3E access to the legacy archive via point-to-point HIPPI connections until they are de-installed
  - Availability of the rcp command and NFS v.2 on the legacy archive server
- LSC and AC access to the data in the legacy archive
- After October 2000, Contractor maintenance of the two STK Powderhorn tape libraries, the 8 Timberline and 4 Redwood tape transports, and the ESCON director while in use
- Dedication of the Timberline and Redwood tape transports to reading files from the legacy archive unless all legacy data has been offloaded to different media

C.4.2.4 Home Directory Filesystem Server (HFS)

- A single high-availability /home filesystem that provides the home directory at login for all computers and workstations at GFDL
- Initial delivery of a minimum of 1 dTB user-accessible formatted disk, exclusive of system disk, on a fault-tolerant disk subsystem
- At least one substantial upgrade to the disk capacity of the HFS during the base contract period

- Government ownership of the HFS at the end of FY2003
- Transfer of all data residing in GFDL's workstation home directories at the time of the HPCS installation to the new /home filesystem
- Transfer of all of the data residing in the T90 and T3E home directories to the new /home filesystem when the T932 and T3E are de-installed
- Availability of the /home filesystem on the LSC and AC via a protocol such as NFS v.3 or DCE/DFS, or as a shared filesystem
- Availability of the /home filesystem, with read/write access, on the T932, T94, and T3E, and user workstations via NFS v.2 and the standard UNIX rcp command
- NFS v.3
- Implementation of per-user and per-group disk space quotas for the /home filesystem
- The ability to view the disk space quota and current disk use via user commands on the LSC, AC, the T932, T94, and T3E, and user workstations
- Failover capability in the HFS
- An availability level of 99.99% for the /home filesystem
- Failover to backup resources completed within 60 seconds

C.4.2.5 Connectivity

- Connection of the LSC, AC, HSMS, and HFS to GFDL's Gigabit Ethernet (GBE) workstation backbone at a minimum of GBE speeds
- Failover access to the HPCS via the GBE backbone
- High-performance file transfers at GBE speeds or better between the LSC, AC, HSMS, and HFS
- Connection of the LSC, AC, HSMS, and HFS to GFDL's computer-room FDDI backbone via single-attach interfaces
- Availability of the /archive and /home filesystems within the HPCS as discussed in sections C.4.5 and C.4.6.
- An upgrade to GFDL’s access to the Internet, to a minimum of T-3 or its equivalent
- Contractor responsibility for all costs associated with the installation and maintenance of the upgraded Internet connection

C.4.2.6 Software

- HPCS software that meets all Government standards
- Contractor maintenance of all software delivered with the HPCS
- Availability of software releases at no additional charge

- System software on the LSC, AC, HSMS, and HFS listed as required in C.4.8.1
- Resource management software on the LSC, AC, HSMS, and HFS listed as required in C.4.8.2
- Programming environment software on the LSC and AC listed as required in C.4.8.3
- X-windows applications software for the AC listed as required in C.4.8.4

C.4.2.7 Reliability, Availability, and Support

- A designated point of contact to request maintenance
- Escalation procedures that allow the Government round-the-clock telephone contact with knowledgeable Contractor staff should the designated point of contact be unavailable
- Preventive Maintenance that is completely performed outside the hours of GFDL primetime
- Uninterruptable power supplies (UPSs) for all components of the HPCS to provide sufficient power during environmental failure to gracefully shut down all components of the HPCS
- At least two software engineers, at least one hardware engineer, and at least one applications analyst available on-site for at least eight hours within GFDL primetime, five days per week
- Additional on-call support 24 hours per day, 7 days per week, with a 2-hour response time
- An itemized list of all Contractor-supplied hardware and software items, and documentation of these items, in printable electronic form
- Training at GFDL for approximately 30 computer specialists and operators in the topics listed in C.4.9.3
- Training at GFDL for approximately 100 applications programmers in the topics listed in C.4.9.3
- A list of additional potential training topics
- Automated backup for the system disks on the LSC, AC, HSMS, and the entire /home filesystem on the HFS
- A combination of full and incremental backups of the /home filesystem to robotically mounted tapes, so that it is possible to restore files to their state on any day during the previous two calendar months
- A history of bimonthly full backups of the /home filesystem for shelf storage until the end of the HPCS system life, and restoration of files from these backups until the end of the HPCS system life

- All hardware and storage media used for backup to be provided by the Contractor
- Pre-delivery access within 30 days after award to systems similar to those proposed for the HPCS
- Technical support during this pre-delivery access period
- Acceptance testing that begins within 90 days of award

C.4.2.8 Facilities

- An HPCS that meets the requirements for power, cooling, and floor space discussed in C.4.10.2 through C.4.10.5
- Replacement of the air-conditioning units and associated equipment as described in section C.4.10.3
- Replacement of flooring as described in section C.4.10.5
- Design and construction of rooms adjacent to the Computer Room as outlined in C.4.10.6

C.4.3 Desired features

The following features are considered desirable on the proposed HPCS:

C.4.3.1 Large Scale Cluster (LSC)

- Binary compatibility of all processors
- The identical configuration of all computational nodes
- The ability to run the same OS level on all computational nodes and processors
- The ability to run two or more different OS levels simultaneously on the same computer on the LSC
- The ability for a single message-passing application to access all of the computational nodes on the LSC
- Total memory that scales linearly with throughput on systems that exceed the minimum throughput requirements
- Resources for interactive work that can be isolated from the batch production resources
- The ability to reassign interactive resources to the batch production jobs during non-primetime hours without a reboot of the entire LSC
- The ability to test OS and application software upgrades in isolation from the interactive and batch production resources on the LSC
- User login to a single hostname
- Failover to processors that are binary-compatible with and running the same OS level as the failed processors

- No single point of failure

C.4.3.2 Analysis Cluster (AC)

- Binary compatibility of all processors
- The identical configuration of all computational nodes
- The ability to run the same OS level on all computational nodes and processors
- The ability to run two or more different OS levels simultaneously on the same computer on the AC
- The ability for a single message-passing application to access all of the computational nodes
- The ability to test OS and application software upgrades in isolation from the interactive and batch production resources on the AC
- User login to a single hostname
- Failover to processors that are binary-compatible with and running the same OS level as the failed processors
- No single point of failure

C.4.3.3 Hierarchical Storage Management System (HSMS)

- A method for determining the location of users' files within the storage hierarchy
- User-specified migration between tiers through a single software interface
- An HSMS that can send files from tape directly to different destinations over the network rather than to just one archive staging filesystem
- The ability for users to group related files and directories that were created at different times onto a single tape volume
- Accounting on the HSMS that reports individual usage at the group and user level of all storage tiers
- The ability to operate and be repaired in degraded mode
- Presentation of the new and legacy data archive to the user as one /archive filesystem image
- Replacement of the T94 with functionally equivalent access to the legacy archive at the end of September 2001

C.4.3.4 Home Directory File Server (HFS)

- The ability to operate and be repaired in degraded mode

C.4.3.5 Connectivity

None at this time.

C.4.3.6 Software

- System software on the LSC and AC listed as desired in C.4.8.1
- Resource management software on the LSC, AC, HSMS, and HFS listed as desired in C.4.8.2
- Programming environment software on the LSC and AC listed as desired in C.4.8.3
- X-windows applications software for the AC listed as desired in C.4.8.4

C.4.3.7 Reliability, Availability, and Support

- Software that allows users to restore /home files from the automated backup via a graphical interface
- Minimal impact of the automated backups on the network load

The requirements and desirable features on the HPCS are described in more detail below.

C.4.4 High-Performance Computing

The HPCS shall provide high-performance computing resources for large-scale computing and analysis capabilities.

C.4.4.1 Large Scale Cluster (LSC)

Scalable supercomputing capabilities shall be provided by a Large Scale Cluster (LSC) of two or more computers (defined in C.6 as the maximum set of nodes that may be unavailable during the repair of any subset of those nodes). The Government desires binary compatibility of all processors and desires the identical configuration of all computational nodes within the LSC (computational nodes are used for numerical computation in the production workload, rather than, e.g., nodes dedicated primarily to I/O). The homogeneity of computational nodes will be evaluated. The ability to run the same OS level on all computational nodes and processors and the ability to run two or more OS levels simultaneously on the same computer in the LSC is desired. It is desirable that a single message-passing application be able to access all of the computational nodes on the LSC.

C.4.4.1.1 LSC performance

The LSC must provide a substantial increase in sustained throughput over that provided by GFDL's current Cray supercomputers described in C.3.1. Sustained throughput shall be measured by an LSC throughput benchmark (section J.3 of this RFP) comprised of concurrently-run parallelized codes sampled from GFDL's expected future workload. This throughput benchmark shall run in no more than 14400 seconds of wallclock time on the initial delivery of the LSC, configured as it will be run in production at GFDL. In addition, the scalability of the LSC shall be measured by a benchmark designed to reveal the performance and scaling characteristics of individual codes as they are executed on

different processor counts. Kernels and microbenchmarks may also be used for evaluating important system operations and interpreting benchmark performance.

At least one substantial upgrade to the sustained throughput of the LSC, as measured by an LSC throughput benchmark, shall be offered during the base contract period. Additional upgrades may be proposed, but the evaluation will favor a limited number of substantial upgrades.

Options to further enhance the LSC throughput after the base contract period shall be offered, as discussed in section C.5.

C.4.4.1.2 LSC memory

A minimum of 144 GB of total memory shall be available for user processes on the initial delivery of the LSC. This memory requirement represents a linear scaling with throughput of the combined (36 GB) main memory and solid-state storage capacity present on the T932. It is desirable that the total memory scale linearly with throughput on systems that exceed the minimum throughput requirements. A minimum of 256 MB/processor is required, and mandatory options for at least 512 MB/processor and 1 GB/processor of memory shall be offered.

C.4.4.1.3 LSC disk I/O

The initial delivery of the LSC shall have fast access to a minimum of 3 dTB of formatted disk, exclusive of system disk (system disk may include, for example, RAID parity disks, swap partitions, and dump partitions). This disk space shall reside on a fault-tolerant disk subsystem. Performance in degraded mode (e.g., when one or more spindles in a RAID-configured disk subsystem ceases to function) will be evaluated. Most of this disk space will be used as temporary storage space for files accessed by the production workload. The Government requires a minimum sustained total I/O bandwidth to this disk of 4 GB/sec. The number of channels to this disk will be evaluated. The minimum capacity and sustained total I/O bandwidth are based primarily on an extrapolation from the rates at which GFDL currently writes data to its temporary storage space to the expected rates at which data will be written in GFDL's projected production workload. The effectiveness with which the I/O subsystem on the LSC can access files, particularly the restart and history files described in section C.3.3, will be evaluated. The disk subsystem shall be able to store files of up to 100 GB in size.

Applications on the LSC shall be able to read file formats written by the AC without explicit library calls for data conversion from within the application. Formats frequently used in LSC and AC applications include FORTRAN sequential and direct-access files and C text and binary stream files.

C.4.4.1.4 Interactive and testing resources on the LSC

The Government desires resources for interactive work that can be isolated from the batch production resources. It has been GFDL's experience that the nature of interactive work creates resource contention with batch production jobs, and batch production jobs slow interactive response time. Credit will be given for the ability to reassign interactive

resources to the batch production jobs during non-primetime hours without a reboot of the entire LSC. The interactive resources will be evaluated by performing compilations, debugging, and file management tasks during scripted interactive sessions on the LSC during the pre-award LTD, concurrent with executing the LSC throughput benchmark.

The Government desires the ability to test OS and application software upgrades in isolation from the interactive and batch production resources on the LSC, for example, in a separate software partition.

User login to a single hostname is desirable.

C.4.4.1.5 LSC reliability, availability, and support

Failover capability for job queuing and scheduling shall be provided. It is required that when any set of resources (such as disk or memory) in the LSC fails, batch jobs using those resources are rerun without user intervention, only interactive sessions hosted on the failed resources are lost, and users must continue to be able to login interactively. It is desirable that failover be to processors that are binary-compatible with and running the same OS level as the failed processors. When any single computer is unavailable for user jobs, the remaining resources shall be capable of running at least two copies of our projected largest job (FMS N270L40, which uses 15 GB of memory). The capability of the LSC to operate and be repaired in degraded mode is required. The LSC shall be fully functional when any part of the Analysis Cluster is halted or powered off. It is desirable that the LSC have no single point of failure. The Government requires an availability level (defined in section C.6) of 96% on every computer in the LSC.

C.4.4.2 Analysis Cluster (AC)

At GFDL, analysis is performed primarily with the use of locally developed FORTRAN codes that are created and modified frequently, as well as the use of third-party software. The potentially short lifetime of locally developed codes makes them, in addition to third-party software, unlikely candidates for parallelization by GFDL scientists. The analysis workload also includes short test runs of batch production jobs on small numbers of processors. These test production runs may use a large number of I/O operations for monitoring execution. All of these analysis jobs may read and write many files and many gigabytes of data.

Enhanced analysis capability shall be provided by an Analysis Cluster (AC) of two or more computers that efficiently execute I/O-intensive FORTRAN codes and third-party software. It is desirable that the AC feature binary compatibility of all processors, the identical configuration of all computational nodes, the ability to run the same OS level on all computational nodes and processors, the ability to run two or more different OS levels simultaneously on the same computer in the AC, and the ability for a single message-passing application to access all of the computational nodes.

C.4.4.2.1 AC performance

The sustained throughput available on the AC should maintain a balance with that on the LSC. Sustained throughput shall be measured by a throughput benchmark comprised in

part of unitasked codes characterized by a higher I/O:compute ratio than in the production codes of the LSC throughput benchmark. An example of such a code might combine many small history files into one large netCDF file, as described in section C.3.3. Short test runs of LSC batch production jobs on small numbers of processors will also be included in the AC throughput benchmark. The wallclock performance of single jobs may also be used to assess performance. Kernels and microbenchmarks may be used for evaluating important system operations and interpreting benchmark performance.

At least one substantial upgrade to the sustained throughput of the AC, as measured by an AC throughput benchmark, shall be offered during the base contract period. Additional upgrades may be proposed, but the evaluation will favor a limited number of substantial upgrades.

By the end of September 2001, the Contractor shall either assume the T94's maintenance payments or replace the T94 with an upgrade to the AC that provides computational performance at least equivalent to the T94, as measured by an AC throughput benchmark. This AC upgrade may be included as part of a more substantial upgrade to the AC. Replacing the T94 is highly preferred over maintaining it beyond September 2001. (Note that replacing the T94 may impact access to the legacy archive, as discussed in section C.4.5.6.) If the T94 is replaced, the de-installation and disposal of the T94 shall be the responsibility of the Contractor.

Options to further enhance the AC throughput after the base contract period shall be offered, as discussed in section C.5.

C.4.4.2.2 AC memory

The Government requires a logically-shared address space, at least 32 GB in size, on all computational nodes of the AC. A minimum of 64 GB of total memory shall be available for user processes on the AC. The Government requires the ability to increase total memory on the AC by increasing the memory on each node (rather than just adding more nodes) or by replacing nodes with ones having larger memory capacities.

C.4.4.2.3 AC disk I/O

The AC shall have fast access to at least 5 dTB of formatted disk, exclusive of system disk (system disk may include, for example, RAID parity disks, swap partitions, and dump partitions). This disk space shall reside on a fault-tolerant disk subsystem. Performance in degraded mode will be evaluated. Most of this disk space will be used as temporary storage space for files accessed by the analysis workload. The Government requires a minimum sustained aggregate I/O bandwidth to this disk of 6 GB/sec. The number of channels to disk will be evaluated. The minimum capacity and sustained total I/O bandwidth is based primarily on an estimate of the size of model datasets produced by GFDL's projected production workload. The disk subsystem shall be able to store files of up to 100 GB in size.

Applications on the AC shall be able to read file formats written by the LSC without explicit library calls for data conversion from within the application. Formats frequently used in LSC

and AC applications include FORTRAN sequential and direct-access files and C text and binary stream files.

C.4.4.2.4 AC reliability, availability, and support

The Government desires the ability to test OS and application software upgrades in isolation from the interactive and batch production resources on the AC, for example, in a separate software partition.

User login to a single hostname is desirable.

Failover capability for job queuing and scheduling shall be provided. It is required that when any set of resources (such as disk or memory) in the AC fails, batch jobs using those resources are rerun without user intervention, only interactive sessions hosted on the failed resources are lost, and users must continue to be able to login interactively. It is desirable that failover be to processors that are binary-compatible with and running the same OS level as the failed processors. The capability of the AC to operate and be repaired in degraded mode is required. The AC shall be fully functional when any part of the LSC is halted or powered off. It is desirable that the AC have no single point of failure. The Government requires an availability level of 96% on every computer in the AC.

C.4.5 Hierarchical Storage Management System

The Government envisions a 2-tiered storage scheme for its data archive, comprised of nearline storage (robotically mounted at high speed) and offline storage (with an emphasis on high reliability), that can effectively satisfy the requests for scientific data that permeates GFDL's scientific workload (as discussed in section C.3.4). If disk is required for caching or staging of files within the HSMS, it shall be fault-tolerant and in addition to the required LSC and AC disk specified in sections C.4.4.1.3 and C.4.4.2.3. The offline data may be mounted either robotically or manually. For nearline and offline data, a data recovery service shall be provided by the Contractor in the event of media failure. Both tape reliability and the data recovery service will be evaluated.

The data archive shall be presented to the users as a single /archive filesystem image.

All storage media used in the HSMS shall be provided by the Contractor, including any new media used in the legacy archive but excluding the Timberline and Redwood tapes in the legacy archive at the time of HPCS installation.

The HSMS becomes the property of the Government at the end of FY2003.

C.4.5.1 HSMS performance

HSMS performance will be evaluated by an archive benchmark that will transfer a mix of large and small files between local disk on the AC and the nearline tier. The benchmark shall be run concurrently with the AC throughput benchmark and complete on the proposed HSMS in no more than 3600 seconds of wallclock time. Kernels and microbenchmarks that test additional aspects of the HSMS may also be used for evaluation.

Data movement between nearline and offline tiers will be evaluated but need be demonstrated only when the offline tier is delivered.

C.4.5.2 HSMS capacity

A schedule for delivery of nearline tape capacity will be mutually agreed upon by the Contractor and the Government. Offline storage is required beginning in October 2001. By the end of FY2003, the nearline tier shall be able to store at least 1000 dTB of data and the offline tier shall be able to store at least 1000 dTB of data. Assuming the optional contract period is exercised, a minimum final total capacity for nearline and offline tiers of 5000 dTB is required by the end of FY2006. The data archive shall be able to store a minimum of 10,000,000 archived files. The HSMS shall be able to store files of up to 100 GB in size.

The HSMS capacity shall be computed independent of compression, at the tape blocksize used by the proposed HSMS.

C.4.5.3 File migration on the HSMS

The Government requires a minimum 10 dMB/s sustained single-file transfer rate from nearline storage to disk, independent of compression. This is approximately the current transfer rate between the Timberlines/Redwoods and the archive staging disk on the T94. The bandwidth between disk and the nearline tier should accommodate GFDL's typical migration patterns as discussed in section C.3.4. A minimum 160 dMB/s aggregate sustained transfer rate between disk and nearline media is required for access to small frequently-used files (as discussed in section C.3.4). Further, a minimum aggregate tape positioning rate, defined in Section C.6, of 1200 mounts per hour shall be provided for access to small frequently-used files. This is approximately twice that currently available on the existing Timberline tape transports. Robot performance in mounting and unmounting tapes must balance the tape positioning rate, and will be evaluated using the archive benchmark results and the proposed tape positioning rate. In addition to the 160 dMB/s aggregate sustained transfer rate for small frequently-used files, a minimum 200 dMB/s aggregate sustained transfer rate between disk and nearline media is required for access to large files (as discussed in section C.3.4).

The aggregate sustained transfer rate between disk and the nearline media shall be computed independent of compression, at the tape blocksize used by the proposed HSMS.

At least one substantial upgrade in the aggregate sustained transfer rate between disk and nearline media is required during the base contract period. If disk is required for caching or staging of files within the HSMS, the capacity of this disk shall be upgraded commensurately.

C.4.5.4 HSMS software

The HSMS software shall provide automatic migration between data archive tiers based on a combination of access time and file size. A method for determining the location of users' files within the storage hierarchy is desirable. User-specified migration between tiers through a single software interface is also desirable. Credit will be given for an HSMS that can send files from tape directly to different destinations over the network rather than to just one archive staging filesystem. Credit will also be given if users can group related

files and directories that were created at different times onto a single tape volume. Accounting on the HSMS that reports individual usage at the group and user level of all storage tiers is desirable.

The /archive filesystem image shall be available on the LSC and AC via a protocol such as NFS v.3 or DCE/DFS, or as a shared filesystem. A high-performance file transfer interface, such as the UNIX rcp command, is also required on the LSC and AC. The /archive filesystem image shall also be available with read/write access on the T932, T94, T3E, and user workstations via NFS v.2 and the UNIX rcp command. NFS v.3 is required for use by future workstations.

C.4.5.5 HSMS reliability, availability, and support

The Government requires failover capability in the server that manages the data archive and requires an availability level of 99.96% for the data archive. Failover to backup resources shall be complete within 300 seconds.

The ability for the HSMS to operate and be repaired in degraded mode is desirable.

C.4.5.6 Legacy archive

All of the data residing in GFDL's DMF data archive, currently hosted on the T94, shall be readable by desktop workstations throughout the base contract period and by the T94, T932, and T3E until these systems are de-installed. This legacy archive shall also be writable by the T94, T932, and T3E until these systems are de-installed. It is desirable that the new and legacy data archive be presented to the user as one /archive filesystem image. Possible solutions include maintaining the T94 throughout the base contract period, maintaining a different DMF archive server throughout the base contract period, or moving the legacy data onto the new HSMS media. Offerors are reminded that COS-blocked files and cpio files with Cray binary headers will remain in the legacy archive.

A legacy archive benchmark that reads files from the legacy archive shall be able to complete in no more than 1800 seconds throughout the life of the legacy archive.

The T94 is Government-owned and includes hardware maintenance through September 2001. If the T94 is used to serve the legacy archive, the Contractor shall provide system administration for the T94, including DMF, after the current contract expires at the end of October 2000. If the T94 is still in use to serve the legacy archive at the expiration of its warranty at the end of September 2001, the Contractor shall assume its hardware maintenance payments. However, it is highly desirable that the Contractor replace the T94 and provide functionally equivalent access to the legacy archive.

If the T94 is not used to serve the legacy archive, functionally equivalent access to the legacy archive shall be provided. In this case, the T932 and T3E shall access the legacy archive via point-to-point HIPPI connections until they are de-installed. The rcp command and NFS v.2 shall also be available on the legacy archive server. This allows locally-developed file transfer scripts to execute correctly.

The LSC and AC shall be capable of accessing all data in the legacy archive. If the T94 is used to serve the legacy archive, the LSC and AC shall access the legacy archive via a high-performance HIPPI or FDDI interface to the T94.

The two STK Powderhorn tape libraries and the 8 Timberline and 4 Redwood tape transports, including integrated IBM ESCON controllers and the IBM ESCON director, currently owned by GFDL will be provided as Government-furnished equipment. There are four ESCON interfaces available on the ESCON director. After October 2000, the Contractor will be responsible for maintaining these tape libraries, drives, and the ESCON director while in use. The Timberline and Redwood tape transports shall be dedicated to reading files from the legacy archive unless all legacy data has been offloaded to different media. The legacy media and tape drives do not count toward the nearline tier requirements of C.4.5.2 and C.4.5.3.

C.4.6 Home Directory Filesystem Server (HFS)

The Government requires a single high-availability /home filesystem which will provide the home directory at login for all computers and workstations at GFDL. A minimum of 1 dTB user-accessible formatted disk, exclusive of system disk, shall be delivered initially. This disk space shall reside on a fault-tolerant disk subsystem whose performance in degraded mode will be evaluated. At least one substantial upgrade to the disk capacity of the HFS is required during the base contract period.

The HFS becomes the property of the Government at the end of FY2003.

Performance of the /home filesystem server (HFS) will be evaluated during Acceptance Testing by a benchmark that transfers files between the HFS and the LSC and AC.

All of the data residing in GFDL's workstation home directories at the time of the HPCS installation shall be transferred to the new /home filesystem. All of the data residing in the T90 home directories (which reside on the T94) and T3E home directories shall be transferred to the new /home filesystem when the T932 and T3E are de-installed.

The /home filesystem shall be available on the LSC and AC via a protocol such as NFS v.3 or DCE/DFS, or as a shared filesystem. The /home filesystem shall also be available with read/write access on the T932, T94, T3E, and user workstations via NFS v.2 and the standard UNIX rcp command. NFS v.3 is required for use by future workstations.

The /home filesystem server shall implement per-user and per-group disk space quotas for the /home filesystem. The quota and current use shall be viewable via user commands on the LSC, AC, the T932, T94, and T3E, and user workstations.

The Government requires failover capability in the HFS and requires an availability level of 99.99% for the /home filesystem. Failover to backup resources shall be completed within 60 seconds on the HFS.

The ability for the HFS to operate and be repaired in degraded mode is desirable.

C.4.7 Connectivity

The Government requires that the LSC, AC, HSMS, and HFS connect to GFDL's Gigabit Ethernet (GBE) workstation backbone at a minimum of GBE speeds. Failover access to the HPCS via the GBE backbone is required. The two Government-furnished GBE interfaces can provide high-performance transfer of files in the HPCS data archive to GFDL's servers and workstations and continued access to the HPCS when one of the two interfaces fails.

High-performance file transfers at GBE speeds or better shall be provided between the LSC, AC, HSMS, and HFS.

The Government requires that the LSC, AC, HSMS, and HFS connect to GFDL's computer-room FDDI backbone via single-attach interfaces.

The /archive and /home filesystems shall be available within the HPCS as discussed in sections C.4.5 and C.4.6.

An upgrade to GFDL’s access to the Internet, to a minimum of T-3 or its equivalent, shall be provided. All costs associated with the installation and maintenance of this Internet connection shall be the responsibility of the Contractor. GFDL may be required to access the Internet via FTS2001 services.

C.4.8 Software

The HPCS Software must meet all Government standards. All software delivered with the HPCS shall be maintained by the Contractor. Software releases shall be made available to the Government at no additional charge.

C.4.8.1 Operating system software

System software required for the LSC and AC is comprised of

1. UNIX-like or licensed UNIX OS
2. X11 windowing
3. NFS v.2, NIS, DNS
4. ftp, rcp, Telnet, BSD lpd
5. SSH Secure Shell (http://www.ssh.org)

NFS v.3 is required on the HSMS and HFS.

System software desired for the LSC and AC includes

1. The same or functionally equivalent OS on the LSC and AC
2. Operator-directed system-level checkpoint/restart capability
3. NFS v.3

GFDL has used operator-directed system-level checkpoint/restart as a critical tool in managing its supercomputing systems over the last 10 years. The level of checkpointing

available on the LSC and AC will be evaluated. Credit will be given for operator-directed system-level checkpointing without user intervention or source-code changes.

C.4.8.2 Resource management software

Efficient operation of the HPCS requires resource management that will facilitate use of the LSC and AC by GFDL's scientists as well as provide maximum throughput for their workload. The Government may wish to implement a variety of charge-back algorithms for monthly processor time or enforce different resource allocations, including disk and tape quotas, at the group and user level on each of the HPCS subsystems.

The Government requires resource management software that provides:

1. Failover capabilities
2. Batch queuing and scheduling
3. Accounting software for the LSC, AC, HSMS, and HFS that reports resource usage at the group and user level
4. System activity monitoring software on the LSC and AC that shows user and system CPU utilization, I/O wait time, and paging activity.

The Government desires resource management software on the LSC and AC that provides:

1. Software partitioning on the LSC and on the AC
2. The status of jobs on the entire LSC and on the entire AC
3. A single hostname for the LSC and a single hostname for the AC presented to the user community.
4. Batch queuing and scheduling that provides
    a. The capability of queues and job scheduling to be based on total disk, memory, processors, and processor time usage
    b. A user interface and an operator interface
    c. Load-balancing capability
    d. Spooling of job scripts and printed output
    e. The ability to request a range of processors on which to run a job
    f. The ability to schedule jobs within a node
5. Job accounting that provides total and high-watermark resource usage (including nodes, memory, and disk)
6. Accounting software that can create separate projects within a group and report the resource usage for each project

7. The ability to set and enforce job resource limits for the number of processors, CPU time, and memory per process, depending on the project or job class
8. System activity monitoring software that can produce a unified report or display user and system CPU utilization, I/O wait time, and paging activity for the LSC as a whole and for the AC as a whole

C.4.8.3 Programming environment software

A single application programming environment common to both the LSC and AC is desired.

Required application software for the LSC and AC programming environments is comprised of:

1. FORTRAN 90/95, C, C++ programming environments, including
   a. ANSI standard FORTRAN 90 and C compilers
   b. macro preprocessors
   c. source-level debuggers
   d. performance profilers
   e. support for 64-bit IEEE reals and integers
   f. support for reading and writing 32-and 64-bit IEEE floating-point formats in I/O operations
2. facilities for source code management, including the "make" utility.
3. netCDF and UDUNITS libraries (available at http://www.unidata.ucar.edu/)
4. NAG numerical libraries
5. MPI-1.1

Desired application software for the LSC and AC programming environments includes:

1. MPI-2 I/O, MPI-2 one-sided communications
2. parallelized, optimized numerical libraries on the LSC and AC
3. optimized (possibly proprietary) I/O libraries.
4. data conversion facilities (for example, endian conversions and conversions of proprietary data formats used in the HPCS)
5. GNU make (http://www.gnu.org/software/make/make.html)

C.4.8.4 X-windows application software

Required X-windows application software for the AC is comprised of:

1. Matlab (http://www.mathworks.com)
2. Ferret (http://ferret.wrc.noaa.gov/Ferret)

3. Mathematica (http://www.mathematica.com)
4. IDL (http://www.rsinc.com/idl/index.cfm)
5. GrADS (http://grads.iges.org/grads)
6. S-Plus (http://www.mathsoft.com)
7. NCAR graphics (http://ngwww.ucar.edu)

Desirable X-windows applications software for the AC includes:

1. NAG Iris Explorer

C.4.9 Reliability, Availability, and Support

The HPCS must continue GFDL's historically high utilization of its computing resources. Reliability, availability, and Contractor support are considered fundamental aspects of the HPCS and are an important aspect of evaluating any proposed HPCS.

C.4.9.1 Downtime

Downtime is that period of time when all of an HPCS component's workload cannot be accomplished due to a malfunction in the Contractor-maintained equipment or software, or when the HPCS or a component of the HPCS is released to the Contractor for maintenance. Periods of Remedial and Preventive Maintenance count as downtime.

Null time is that period of time when the workload cannot be accomplished due to environmental failure, such as loss of electric power or cooling, or recovery from environmental failure. Null time will not be counted as downtime.

The Government shall be the sole determiner of whether any HPCS component's workload can be accomplished. Downtime is accumulated on the LSC and AC when either the HSMS or HFS is down.

The Contractor shall provide the Government with a designated point of contact to request maintenance. The Contractor shall maintain escalation procedures that allow the Government round-the-clock telephone contact with knowledgeable Contractor staff should the designated point of contact be unavailable.

A component's downtime shall commence at the time the Government makes a bona fide attempt to contact the Contractor at the designated point of contact. At this time the Government will begin a log of the problem which will be completed and signed by both the Government and the Contractor when the problem is resolved. Information to be entered into the log will be determined by the Government.

A component's downtime shall exclude any time in which the Government denies the Contractor maintenance personnel access to the malfunctioning hardware and/or software.

A component's downtime shall end when the computer is returned to the Government in operable condition as determined by the Government, ready to perform all of the workload.

Preventive Maintenance (PM) is to be completed outside the hours of GFDL primetime (7am-7pm).

The testing and installation of Operating System upgrades will count as downtime.

Preparation for post-upgrade LTDs, including any benchmark development by the Contractor, will count as downtime.

C.4.9.2 Availability

Proposed throughput benchmark performance levels will be combined with the proposed availability level to determine a measure of overall proposed system-life throughput for the LSC and for the AC. The actual throughput will be measured on a periodic basis, to be determined by the Government and Contractor, by combining the demonstrated benchmark performance with the operational use time on the LSC and on the AC. The proposed performance levels must be met for each measurement of actual throughput regardless of past delivery of suites.

Shortfalls in throughput on the LSC or on the AC shall be made up with new equipment brought in at no additional cost. Using the demonstrated benchmark performance on the upgraded LSC or AC, the Government will calculate how long the upgrade shall stay in place to compensate for the shortfall in throughput. This will be rounded up to a multiple of 6-month intervals to minimize disruption.

At the option of the Government, shortfalls in throughput on the LSC or on the AC due to downtime shall cause downtime credits to accrue, as cited in section F.3.3. These downtime credits shall be in lieu of bringing in new equipment. Downtime credits shall accrue on the HSMS or HFS as cited in section F.3.3.

To better reflect GFDL's computational needs over time, changes in the LSC and AC throughput benchmarks shall be made by mutual agreement between the Government and the Contractor throughout the life of the HPCS.

Accumulated computational cycles (in CPU-hours) that are lost when jobs are lost due to component failure or component reboot will not count toward the system-life throughput calculation. If the accounting software cannot report the accumulated computational cycles, it will be assumed that 4 CPU-hours were lost for each processor on which the job ran.

All performance levels proposed for hardware and software upgrades must be met regardless of past delivery of suites.

Uninterruptable power supplies (UPS) are required for all components of the HPCS. These shall provide sufficient power during environmental failure to gracefully shut down all components of the HPCS.

C.4.9.3 Support

The Government requires at least two software engineers (to provide a comprehensive system administration service), at least one hardware engineer, and at least one applications analyst available on site for at least eight hours within GFDL's primetime window, five days per week. Additional on-call support shall be provided 24 hours per day, 7 days per week, with a 2-hour response time. The Government reserves the right to substitute hardware engineers with software engineers or application analysts during the life of the contract on an as-needed basis. Problem escalation procedures will be evaluated.

The Government requires an itemized list of all Contractor-supplied hardware and software items, and documentation of these items, in printable electronic form.

Training at GFDL shall be provided for approximately 30 GFDL computer specialists and operators in the following areas on the LSC, the AC, HSMS, and the HFS:

- system administration and tuning
- hardware operation and system overview

Training at GFDL shall be provided for approximately 100 applications programmers in the following areas on the LSC and the AC:

- application and shell programming
- programming languages and tools
- HSMS software user interface

The Contractor shall provide the Government with a list of additional potential training topics.

The Government may wish to begin training when pre-delivery access to systems similar to those proposed for the HPCS, cited in Section C.4.9.5, is granted.

C.4.9.4 Automated backup

Automated backup shall be provided for the system disks on the LSC, AC, HSMS, and the entire /home filesystem on the HFS. Software that allows users to restore /home files via a graphical interface is desirable.

For the /home filesystem, a combination of full and incremental backups shall be done to robotically mounted tapes. These backups shall make it possible to restore files to their state on any day during the previous two calendar months. Minimal impact of these backups on the network load is desired.

For the /home filesystem, a history of bimonthly full backups shall be produced for shelf storage until the end of the HPCS system life. It shall be possible to restore files from these backups until the end of the HPCS system life.

All hardware and storage media used for backup shall be provided by the Contractor.

C.4.9.5 LTD

The Government requires a pre-award live test demonstration (LTD) on the HPCS hardware offered initially or its functional equivalent. A description of the LTD is provided in Section L.5.5. The Government requires an LTD on the hardware offered for all upgrades at the time of each upgrade.

Within 30 days after award of contract, the Government shall have pre-delivery access to systems similar to those proposed for the HPCS to develop and test codes and scripts. Technical support shall be provided for this purpose.

Acceptance testing shall begin within 90 days of award. Acceptance of all upgrades shall begin on the first day of the month proposed for the upgrade.

C.4.10 Facilities Description and Requirement

C.4.10.1 Overview

The HPCS will be installed in the Computer Room of the GFDL Computer Building, which is located behind the main GFDL building. These two buildings, together with ten acres of land, make up the GFDL Complex, which is located on the B Site of Princeton University's Forrestal Campus in Plainsboro Township, Middlesex County, New Jersey. The Complex is leased from Princeton University through a triple-net lease agreement under which the University owns the buildings and land, but the Government has primary responsibility to maintain the buildings and the equipment therein. Princeton University provides water and sewage utilities and maintains campus roads and grounds; however, GFDL purchases electricity and natural gas directly from the local utility, Public Service Gas and Electric (PSE&G). The Government obtains day-to-day facility support from the University on an on-going basis.

The GFDL Computer Building was constructed in 1980 in order to provide a dedicated facility to house the Laboratory's central computer system and associated equipment and to provide office space for the GFDL Computer Systems and Operations staff and Contractor support personnel. The new building was designed to provide sufficient raised floor space in the computer room to allow GFDL to operate two generations of systems concurrently, together with associated data archival storage, during transitions from one generation system to the next. When the Laboratory's UNIX workstation network was installed throughout the Laboratory buildings in the late 1980's, GFDL installed network servers and routers in the Computer Building as well.

C.4.10.2 Available Power

The existing electrical service to the GFDL Complex and the rest of Princeton University's B-Site of Forrestal Campus is served from a PSE&G utility substation, a 2000 kVA 13200 to 4160 volt oil filled transformer and 4160 volt switchgear. This substation is located outside of the southwest corner of the Computer Building directly adjacent to the parking lot. This substation has been sized based on the power requirements of both the GFDL Complex and the rest of the B-Site of Forrestal Campus; the great majority of the power demand on the substation is used by GFDL, and there are recent university plans to dedicate the substation for GFDL's sole use. PSE&G will also be evaluating an option to upgrade the substation transformer during the next six months.

If the power available to the Computer Building becomes inadequate for the new equipment to be installed in the Computer Room at any time during the contract life, the Contractor will have the responsibility to assure that adequate power service is provided to the building. In this case, the Contractor shall ask the owner, Princeton University, to request that PSE&G upgrade the electrical service as required.

An underground 4160-volt feeder, dedicated to the GFDL Complex, is routed from the utility substation to separate building substations located within the GFDL Main Building and Computer Building. GFDL will work with Princeton University to upgrade this underground feeder line during the summer of 2000.

The Main Building substation (1500 kVA 4160 to 480 volt transformer) provides power to the Main Building and to the Chilled Water Plant for the GFDL Complex. The subsequent analysis will only deal with the Computer Building substation, which is to be the only source of power for the new equipment to be installed in the Computer Room.

The Computer Building substation is located in the Transformer Room, the location of which is shown in Figure 2. This substation is comprised of a 4160-volt air interrupter switch, 1500-kVA silicone-filled transformer, and a 2000-ampere, 480/277-volt main switchboard. This equipment was installed around 1980 when the Computer Building was constructed. The substation provides power to the Computer Building and to a 225-ton chiller and cooling tower (referred to as Chiller #4) that will serve primarily as a backup to the Chilled Water Plant once the upgrade to this plant becomes operational this spring.

The lighting, large mechanical equipment (backup chiller, pumps, A/C units, etc) and some computer equipment are served at 480/277 volts via panel boards located throughout the Computer Building. The building receptacles, small motors, desktop computers, computer room equipment, and similar loads are served at 208/120 volts via step-down transformers and panel boards. The initial HPCS, which is to be operated in parallel with the existing SGI/Cray equipment, may require additional 480/277-volt and 208/120-volt panel boards to support the new equipment as part of site preparation.

A demand meter is installed as part of the Computer Building substation. This meter was set to record the building demand for a period of one week. The meter indicated a maximum building demand of 595 kVA. This load was taken at a time of the year when Chiller #4 was not in operation. The maximum demand load associated with this chiller is approximately 230 kVA. Therefore, the worst case building demand is a total of these two numbers (595 kVA and 230 kVA), or 825 kVA.

The Computer Building substation capacity is 1500 kVA. The additional capacity remaining in the Computer Building's substation is the difference of the total capacity and the demand (1500 kVA minus 825 kVA), or 675 kVA, at the initial installation when all of the SGI/Cray equipment is still operating.

Table 4 provides estimates of the power usage for current equipment in the Computer Room. The equipment listed is expected to be sharing power with the initial HPCS during the period of overlapping operation.

If power requirements for the systems to be installed exceed the power available from the existing Computer Room substation at any time during the contract life, the Contractor must upgrade this substation to provide the needed power capacity and make any other necessary changes to assure the delivery of the needed power. This upgrade will be performed at no additional cost to the Government. The Contractor has sole responsibility for obtaining any construction licenses, permits, and approvals for this work from Plainsboro Township and Princeton University, as required.

Table 4. Estimated Power Usage of Current Equipment in the Computer Room

Equipment	Estimated Power Usage (KVA)
T932	410
T3E	77
T94	68
StorageTek Silos (2)	20
Air Handler A/C Units (7)	55
Printers (9)	12
Lighting	20
Total	662

Table 4a provides a history of expenditures and use of power over the period from FY 1995 through the first four months of FY 2000. During the period prior to FY 1999, GFDL benefitted from a lower rate, because it used power from Princeton University. At the beginning of FY 1999, the Forrestal Campus B-Site moved to commercial power, with a resulting increase in the cost per KwH. Power rates decreased again in FY 2000 due to the effects of power deregulation in New Jersey.

The power usage shown in this figure is explainable by the supercomputer power and cooling load that dominates the Lab's usage. In particular, the Table 4a shows the progressive increase in usage following the overlap period in FY 1996 as additional SGI/Cray equipment are added to the Computer Room. The FY 1994 - FY 1995 usage primarily involved the load of the Cray Y-MP8/8 with two months of the Cray C-9016/16 at the end of FY 1995. FY 1996 reflects overlapped operation of the C-9016/16 and Y-MP8/8 for the first eight months of the fiscal year. FY 1997 reflects T932/20 and T3E operation with the T932 upgraded to 26 CPUs for the last 7 months of the year. FY 1998 usage reflects the addition of the T94/4 near the beginning of the year. FY 1999 usage reflects the upgrade of the air-cooled 40-pe T3E to a water-cooled 128-pe system.

Table 4a. GFDL Power Usage and Expenditures by Fiscal Year for FY 1994 - FY 2000

	Annual Use (KwH)	Expenditure	Avg. Cost/KwH
FY 1994	6,652,160	$420,812	$0.0633
FY 1995	6,286,400	$430,826	$0.0633
FY 1996	9,095,360	$631,267	$0.0685
FY 1997	7,700,800	$511,684	$0.0694
FY 1998	8,085,760	$554,758	$0.0664
FY 1999	8,826,400	$713,948	$0.0686
FY 2000 (thru Jan.)	3,025,600	$212,176	$0.0809

C.4.10.3 Available Cooling

Two centrifugal chillers and cooling towers make up the primary Chilled Water Plant, which is located in the mechanical room and tower bay southeast of the Transformer Room (see Figure 2). These chillers will be rated at 400 and 380 tons and are referred to as Chiller #2 and #3 respectively. Chiller #2, the new 400-ton chiller, is being installed in the spring of 2000 along with new cooling towers and pumps. Chiller #3, installed in 1996, will be upgraded from 350 tons to 380 tons capacity as part of this renovation. The Government desires that these systems be operated in such a way that only one chiller is required on most days. The two chillers are intended to provide redundancy and to only be required on days in which cooling demands are high. However, during initial installation of the HPCS, both chillers may be needed on warm days in order to support both the new system and the SGI/Cray systems, running in parallel. Chiller #4, located in the Transformer Room, is approximately 21 years old and will not be considered as a part of the normally operating Chilled Water Plant after the spring 2000 renovation. This chiller, which has been derated from 225 to 205 tons, will only be used for emergencies or as backup to partially support the cooling load during short periods of time when one of the primary chillers is taken off-line for servicing or repair.

Cooling is delivered to the Computer Room through a six-inch piping system from the mechanical room at a temperature of 45 degrees Fahrenheit, plus or minus 2 degrees. The pipe enters the Computer Room in a trench that is 3-4 feet deep under the raised floor in the center of the Computer Room, as indicated in Figure 2. It is currently connected to five (5) air conditioning (blazer) units located on the raised floor, as well as to the refrigeration units of the existing SGI/Cray systems. Four (4) air conditioning units, each rated at 20 tons, are distributed in the center of the Computer Room, while one 40-ton unit is located near the doorway to the loading dock. The locations of these five units are indicated by blue rectangles in Figure 3, which shows details of the room layout as of the

summer of 2000. These existing air conditioning units, with compressors, refrigeration circuits, etc., are estimated to be 21 years old; because of their age, the Contractor must replace them as part of the site preparation work.

Two (2) 6,000 CFM chilled-water-cooled air handlers (not shown in Figure 3), with an estimated available capacity of 15 tons each, are mounted on the ceiling above the uninterruptable power supply (UPS) equipment for the T932, located in the UPS Room in the northern corner of the Computer Room. These two units appear to be in reasonable condition and may be reused for this area if new UPS equipment is placed in the same area as the present T932 UPS equipment. These units can only be used for this type of application per their present configuration.

The space available below the raised floor is 22 inches in height over most of the raised floor, except for the deeper chilled water trench that extends down the middle of the room. The raised floor itself is two feet above the concrete subfloor.

A chilled water air handler, located outside of the Computer Room, provides heating, cooling, and ventilation to the Computer Room for general non-equipment loads, and serves as the means for introducing outside air into this space. This unit also serves the offices, storage areas, corridors, and other spaces within the Computer Building.

Figure 4 shows the projected chilled water flow diagram, including the three chiller units that have been cross-connected to allow for backup and parallel operation. This configuration will allow for up to 780 tons of cooling capacity with the two new chillers, Chiller #2 and #3, in operation at one time. Chiller #4 is assumed to only be used for emergency or backup. There is also a spare set of insulated, capped eight (8) inch lines that run between the mechanical room and the computer room trench. This set of 8" lines is available for use to pipe up the Initial System equipment and the new air conditioning (blazer) equipment without disturbing the existing equipment.

By accounting for the peak building cooling loads of GFDL’s Main Building and Computer Building, the Government concludes that the maximum cooling capability that will be available to the Computer Room with both chillers (Chillers #2 and 3) operating is 5,000 KBTU/hr or 415 tons. This capacity would drop by approximately 195 tons to 220 tons or 2,640 KBTU/hr if the 400 ton chiller (Chiller #2) was shut down for service, and the 225-ton backup chiller (Chiller #4, rated at 205 tons) was operated in its place. The use of Chiller #4 in this situation would also use power from the Computer Room substation as indicated in the previous section. Figure 4 does not include the present loads as detailed in the Table 5 below. The Initial System could initially utilize up to approximately 3,000 KBTU/hr if Chillers #3 and 4 were required to operate in emergency mode with the existing SGI/Cray computers during the period of parallel operation.

The following estimates of cooling load by equipment category are provided as a guide. The equipment listed will be sharing cooling with the Initial System during the period of overlapping operation. Offerors should also consider cooling loads of equipment that will remain once the T932 and T3E systems are removed.

If cooling requirements for the systems to be installed exceed the power available from the existing Chilled Water Plant at any time during the contract life, the Contractor must upgrade the chilled water facility to provide the needed cooling capacity and make any other necessary changes to assure the delivery of the needed cooling, including the upgrade of associated substation capacity to provide sufficient power for the upgraded chiller system capabilities. This upgrade will be performed at no additional cost to the Government. The Contractor has sole responsibility for obtaining any construction licenses, permits, and approvals for this work from Plainsboro Township and Princeton University, as required.

Table 5. Estimated Cooling Load of Current Computer Room Equipment

Equipment	Estimated Cooling Load (BTU/hr)
T932	1,330,100
T3E and T94	450,000
StorageTek Silos (2)	55,000
Operator Workstations	8,000
Printers (9)	34,000
Lighting	31,000
Total	1,908,100

C.4.10.4 Room Layout and Access

Figure 3 shows the computer room layout that is expected in the summer of 2000 prior to the beginning of site preparation. References to the front of the room in the following discussion refers to the bottom of the figure (nearest to the Ready Room), while the back of the room is at the top of the figure. The rooms shown at the bottom of the figure from left to right are:

- Loading Dock, which is designed to accept deliveries from 18-wheel trucks.
- Storage Room adjacent to the Loading Dock, which also serves as a receiving/staging area for deliveries to the Laboratory.
- Vendor Room, which provides office space for Contractor personnel of the existing system.
- Ready Room, where users currently interact with the operations staff and retrieve printouts from the bins that are built into the wall between the Ready Room and the Computer Room.
- PC Storage Room, which currently provides space for miscellaneous storage.

- Door and Corridor, which is the primary entrance to the Computer Room.
- Operations Lounge.

Equipment access to the Computer Room from the Loading Dock is through two sets of double doors with clearances of 85 inches high by 70 inches wide.

Two rooms have been constructed in the rear of the Computer Room. The room on the right contains the UPS equipment for the T932 system. The room on the left (designated as Vendor Area), constructed on the raised floor during a previous installation, is used by the current Contractor as a storage and test area. This room will be available for use by the new vendor; it may be dismantled as part of site preparations if the vendor requires additional raised floor space.

Other details of the figure are as follows. The current SGI/Cray equipment is: T932 (green), which includes the UPS equipment located in the right rear room; T3E (gray); and T94 (purple), which includes UPS equipment located along the rear wall which supports both the T94 and T3E. The workstations associated with each of these systems are located in the center of the room. The two StorageTek silos and associated equipment (yellow) are located in the front right side of the room. Thin lines within the Computer Room indicate the locations of the current cooling pipes for the SGI/Cray equipment. The five (5) blue rectangles in the figure designate the positions of the air conditioning (blazer) units, as discussed previously. The X-symbols within boxes indicate the locations of the eight support columns in the middle of the Computer Room. Additional equipment expected to be in the room in summer of 2000 are: nine (9) Government-owned printers (2 HP LaserJet 8100N, 4 HP LaserJet 5M, and 3 Tektronix Phaser 740 printers) (dark blue), located in the front nearest to the Ready Room; network communications equipment (bright red); network UPS equipment (dark green with red border); administrative network servers (pink); and electrical and fire alarm panels (brown), located on walls throughout the Computer Room.

C.4.10.5 Available Floor Space and Raised Floor Replacement

As indicated in Figure 2 and 3, the entire Computer Room is 10,004 square feet in size, with dimensions of 122 feet by 82 feet; this includes the Vendor Area Room to the left rear and the current UPS Room on the right rear of the Computer Room. The raised floor area, indicated by a grid of squares depicting each two-by-two-foot floor tile, is 7,052 square feet in size, with dimensions of 86 feet by 82 feet; the presence of the temporary Vendor Area room in the left rear, with dimensions of 20 by 26 feet, reduces the currently available raised floor space to 6,532 sq. ft. The non-raised floor on the left side of the room is 1,476 square feet, with dimensions of 18 by 82 feet. The non-raised floor on the right side is 936 square feet, with dimensions of 18 by 52 feet, reflecting the presence of the UPS Room.

The existing raised floor sections were installed at three different times. The locations of these sections are indicated by Figure 5, which distinguishes these three groups by color according to the year in which each was installed. The blue and red sections of Figure 5, which were installed respectively in 1990 and 1995, have anti-static carpeted panels. The raised floor is electrically interconnected to provide a common electric reference. The

raised floor is designed to support a uniform live load of 250 pounds per square foot, with a deflection of not more than 0.040 inch. Great care must obviously be taken in moving heavy equipment across any raised floor so as to distribute equipment loads evenly.

The raised floor shown in green in Figure 5 was installed in 1980. Any sections of this older flooring that will be used to support new equipment must be replaced as part of the site preparations before new equipment is moved onto it. In fact, the Government recommends that the Contractor test the integrity of floor sections and supports and, if necessary, replace any floor sections and supports that are inadequate before installing new equipment.

The Government's past strategy for floor space usage in the GFDL Computer Room has been to limit the amount of space available to the new Contractor to no more than half of the total raised floor space within the room. The purpose of this was to leave sufficient space unoccupied so that the follow-on contractor would be able to install and operate the next system in parallel with the current system. With this objective in mind, the Government desires that the Contractor restrict his use of floor space, both raised and solid, to no more than half of the total space within the Computer Room. If the new equipment uses more than half of the available floor space, the proposal must provide recommendations on how the Government can design the follow-on procurement and installation in order to provide for overlap of systems.

C.4.10.6 Facility Renovations to Provide Rooms for Operators and Printers

Under the current arrangements, the GFDL Operations staff operates the SGI/Cray systems from workstations located in the Computer Room itself. In addition, the operations staff is responsible for managing printers located in the Computer Room. These printers are currently the primary means by which GFDL users produce printed output. The Government has concluded that the operations control area should be moved out of the main computer room for two reasons: to provide the Operations staff with a quiet work environment, and to increase the raised floor space available for equipment. Users will need to have reasonable access to the Operations staff, in a manner that maintains acceptable physical security and restricted access to the Computer Room. In addition, user bins should be accessible by users while being located close to the printers, which should also be moved out of the main computer room.

With these objectives in mind, the Government requires that the current Ready Room and PC Storage Room (Figure 3) be renovated to provide an Operations Room and a User Support Room. The Operations staff will oversee and manage the systems and networks from the new Operations Room. The User Support Room will be divided into a Printer Area and a User Area, separated by a wall containing user bins and an input counter. The user bins are cubicles reserved for individual users' printed output. The input counter is an open counter area where users can communicate directly with the operations staff and packages (FedEx, UPS, etc.) can be received by Operations.

The upper frame of Figure 6 is an enlargement of the current layout of the Ready Room, PC Storage Room, and Operator's Lounge as taken from Figure 3. The lower frame of this

figure shows a schematic of a proposed layout for the Operations Room and User Support Room and their position relative to the Operators' Lounge.

Both the Operations Room and the Printer Area must have at least a 6-inch raised floor to accommodate wiring for the various consoles and printers. The back walls of the Operations Room and Printer Area (adjacent to the Computer Room) will have large glass windows to provide a view of the Computer Room. All doors leading to the Computer Room must be equipped with DOC-approved security devices. Presently, the Laboratory has card readers and cipher locks installed on doors accessing the Computer Room.

The design should provide for quick access to the fire alarm panel and environmental monitoring system. All necessary operating consoles, including consoles for network servers, shall be relocated to the Operations Room and shall be designed to provide convenient access. Cameras shall be placed in strategic locations within the Computer Room with associated monitors installed in the Operations Room. This will enable the Operations staff to observe the Computer Room in areas that are not visible through the glass windows.

This construction is likely to require modifications to mechanical and electrical systems in order to provide the additional capacity in these rooms for the equipment being relocated. Additional ventilation may also be needed. The Contractor has sole responsibility for obtaining any construction licenses, permits, and approval for this work from Plainsboro Township and Princeton University, as required. Construction of these rooms can proceed in parallel with the beginning of the Acceptance Test but must be completed, with occupancy permits, prior to the successful completion of the Acceptance Test.

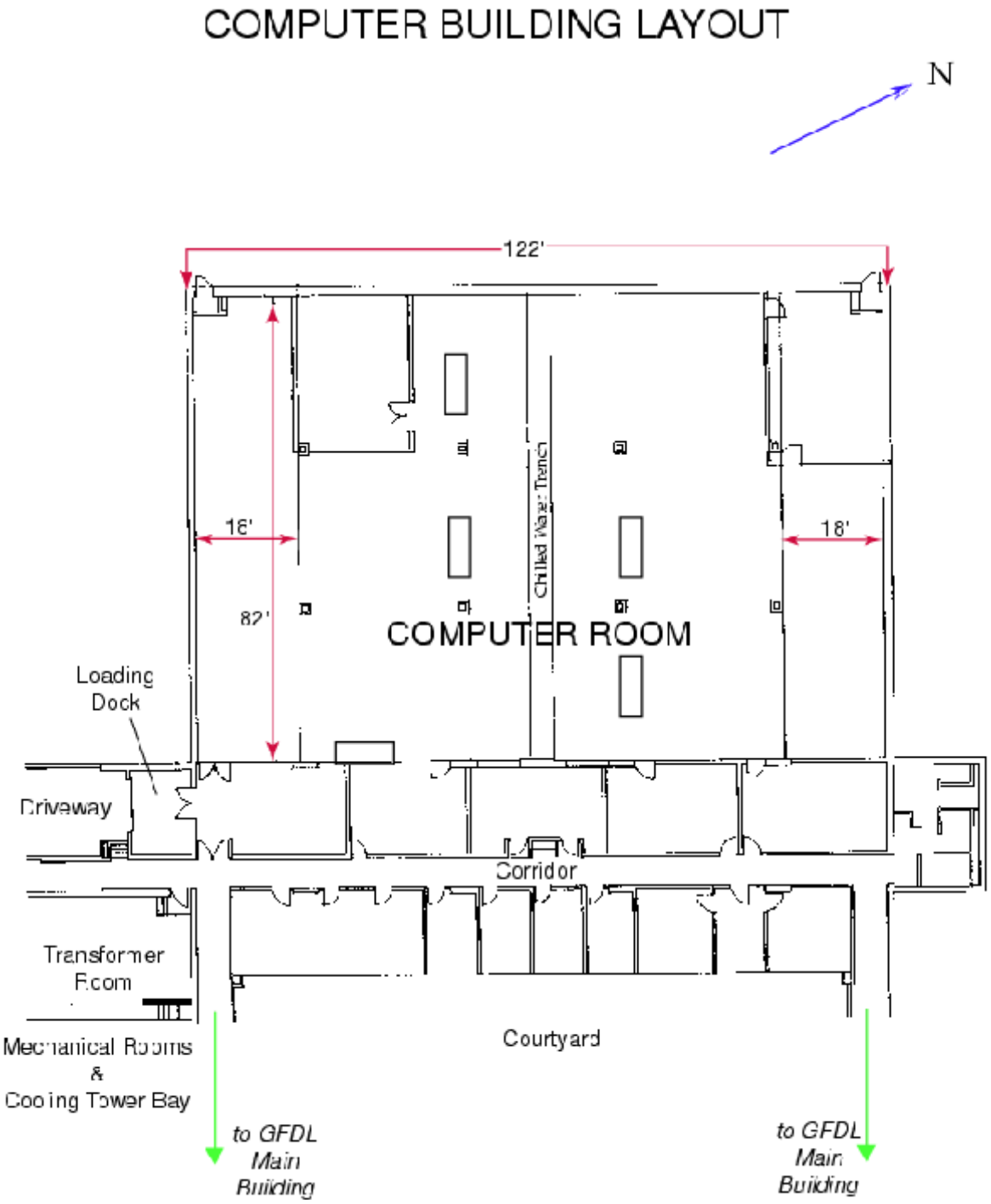


Figure 2. Diagram of the Computer Building (for General Reference Only)
(Note: Some wall partitions of rooms adjacent to Corridor have since been modified)

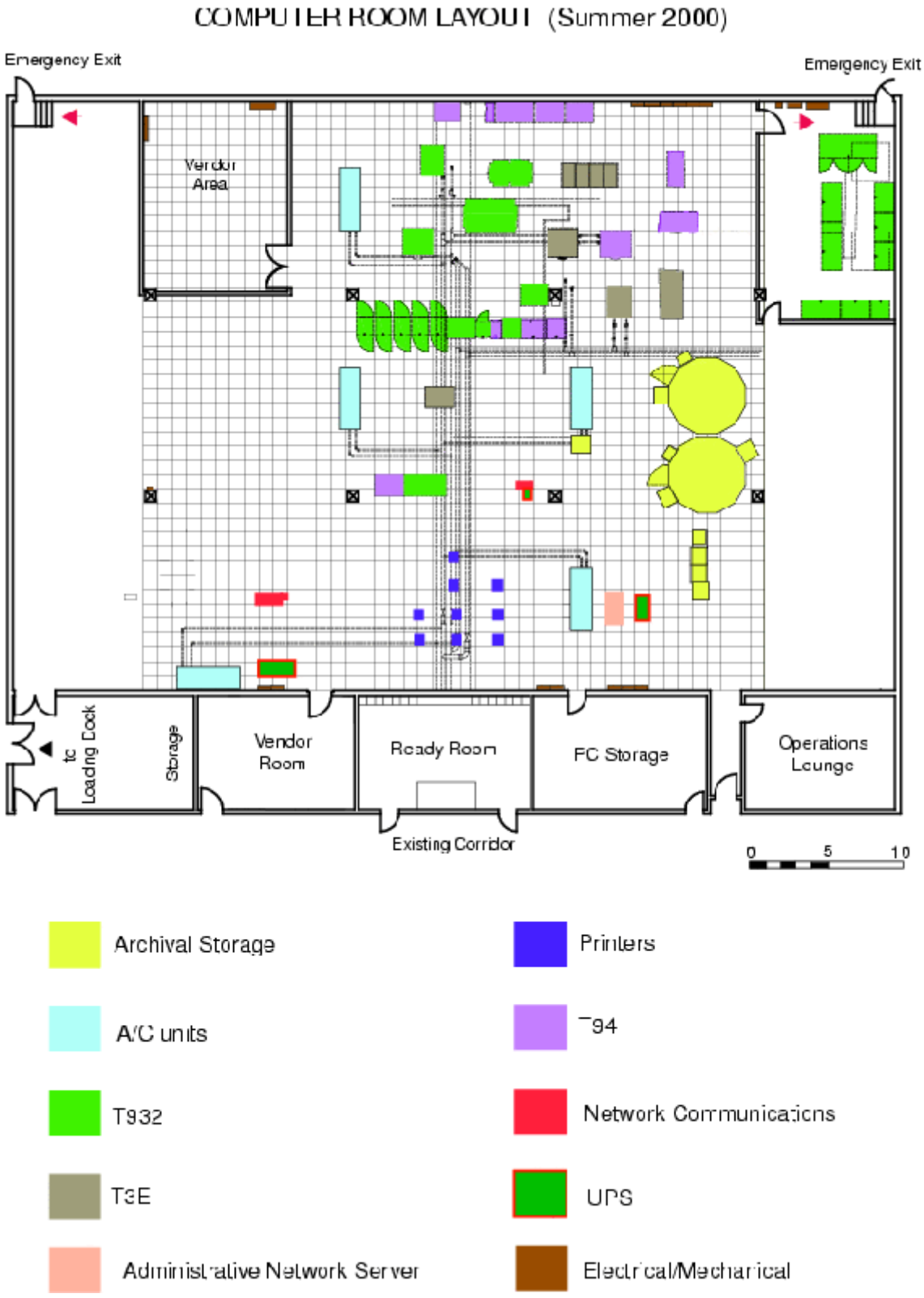


Figure 3. Equipment Layout in the Computer Room (Summer 2000)

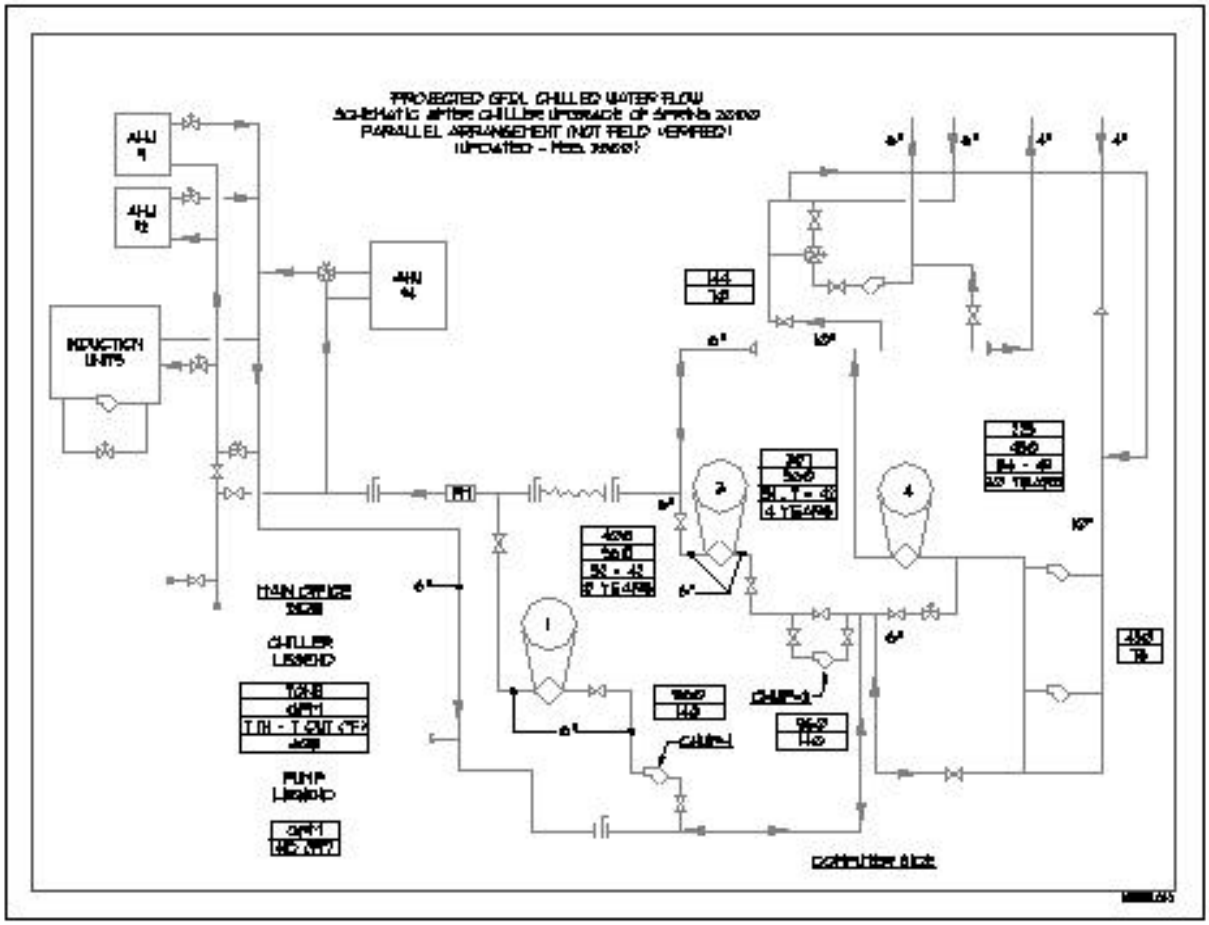


Figure 4. Projected GFDL Chilled Water Flow Diagram (Summer 2000)

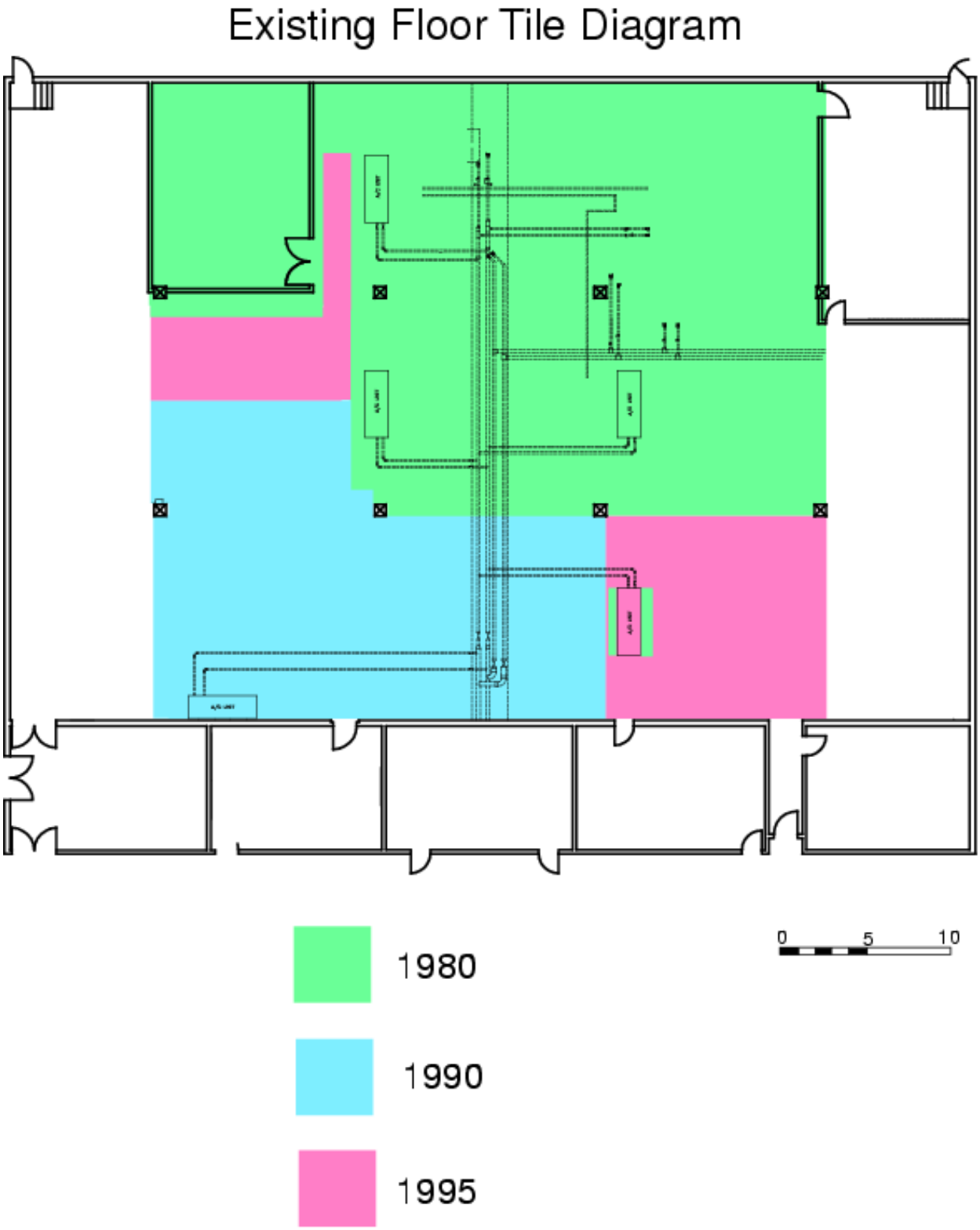
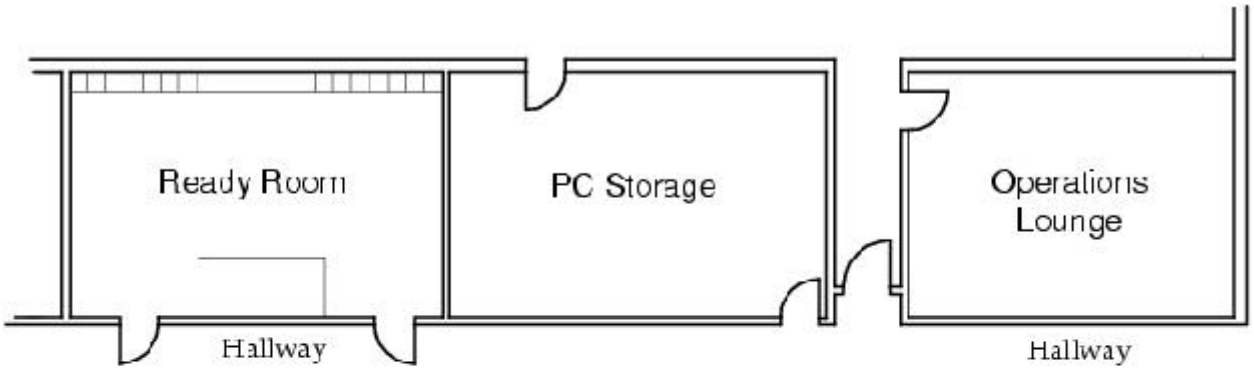
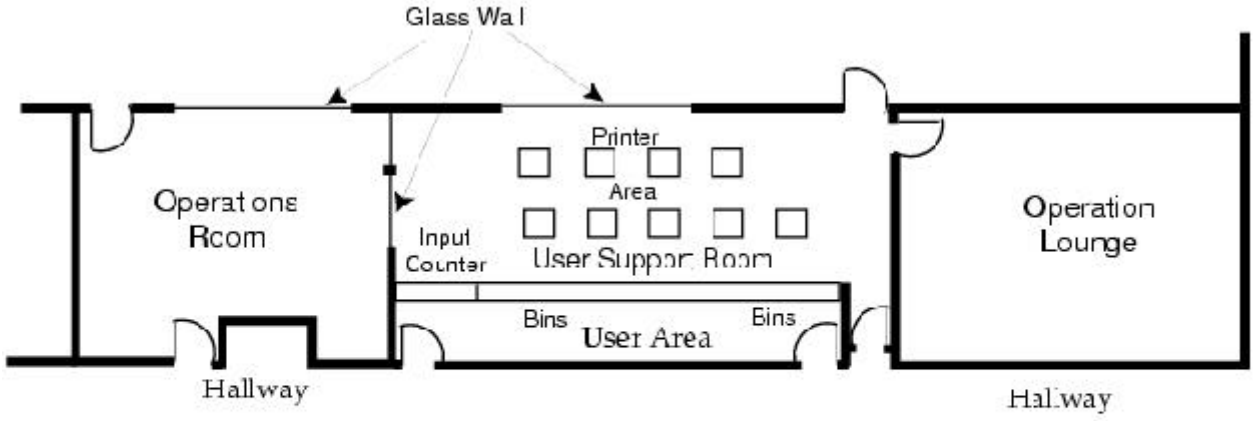


Figure 5. Location of Raised Floor Sections According to Year of Installation



Existing Floor Plan

No Scale



Schematic of New Floor Plan

No Scale

Figure 6. Original Floor Plan and Schematic of Proposed New Design

C.5 Options

Mandatory options for minimums of 512MB and 1GB of main memory per processor on the initial LSC shall be offered. The Government reserves the right to exercise either or both of these options at any time during the base contract period (FY2000-2003).

Three one-year options that provide guaranteed increased performance levels on both the LSC and AC shall be offered. Only the performance levels proposed for these option years will be considered in awarding the HPCS contract.

C.6 Definitions

The following definitions, listed in alphabetical order, will be used in this Statement of Need:

Aggregate Tape Positioning Rate. The aggregate tape positioning rate P is defined as

$$P = N * 3600 / (L + R + S)$$

where N = number of drives proposed for small frequently-accessed files, L = the load and thread time in seconds, S = the median search time, in seconds, for the proposed tape volume based on the way the HSMS software searches for archive files, and R = the median rewind time for the proposed tape volume in seconds.

Availability Level. The availability level of a computer, component, or device is a percentage figure determined by dividing the operational use time by the difference between wallclock and null time.

Byte. Eight (8) bits.

Cluster. A collection of nodes with a dedicated interconnect.

Computer. The maximum set of nodes that may be unavailable during the repair of any subset of those nodes.

DCE. Distributed Computing Environment.

Decimal Gigabyte (dGB). Ten (10) to the power of nine (9) bytes.

Decimal Gigaword (dGW). Ten (10) to the power of nine (9) words.

Decimal Kilobyte (dKB). Ten (10) to the power of three (3) bytes.

Decimal Kiloword (dKW). Ten (10) to the power of three (3) words.

Decimal Megabyte (dMB). Ten (10) to the power of six (6) bytes.

Decimal Megaword (dMW). Ten (10) to the power of six (6) words.

Decimal Terabyte (dTB). Ten (10) to the power of twelve (12) bytes.

Decimal Teraword (dTW). Ten (10) to the power of twelve (12) words.

Degraded Mode. System operation at less than normal capability due to the loss of hardware or software components on that system.

DFS. Distributed File Service.

DNS. Domain Name System.

Downtime That period of time when all of an HPCS component's workload cannot be accomplished due to a malfunction in the Contractor-maintained HPCS hardware or software, or when the HPCS or a component of the HPCS is released to the Contractor for maintenance.

Failover. In the event of a failure, resources are available to assume and resume the tasks that were using the failed resources without user or operator intervention.

Gigabyte (GB). Two (2) to the power of thirty (30) bytes.

Gigaword (GW). Two (2) to the power of thirty (30) words.

Kilobyte (KB). Two (2) to the power of ten (10) bytes.

Kiloword (KW). Two (2) to the power of ten (10) words.

Megabit (Mb). Two (2) to the power of twenty (20) bits.

Megabyte (MB). Two (2) to the power of twenty (20) bytes.

Megaword (MW). Two (2) to the power of twenty (20) words.

Migration. The movement of the contents of a disk-resident file to tape volume(s), or the movement of a file's contents from tape volume(s) back to disk storage.

NFS. The Network File System as defined by specifications placed into the public domain by Sun Microsystems, Inc.

NIS. The Network Information Service as defined by specifications placed into the public domain by Sun Microsystems, Inc.

Node. A collection of one or more processors and one or more memory modules that communicate among themselves with a different communication architecture (in protocol, organization, or performance) than they use to communicate with other nodes.

Null Time. The time during which equipment is unavailable to the Government, exclusive of downtime.

Operational Use Time. The time during which equipment is available to the Government, exclusive of preventive maintenance time, remedial maintenance time, standby time, or Contractor-caused machine failure. Partial credit may be given by the Government for equipment operating in degraded mode (for example, when a portion of the processors, memory, disk, etc. on a computer is unavailable). The Government may declare the entire HPCS down even if parts of the HPCS are available.

Preventive Maintenance (PM). That maintenance performed by the Contractor which is designed to keep the equipment in proper operating condition. It is performed on a scheduled basis.

Primetime. 7am to 7pm Eastern Time, Monday through Friday.

Processor. The minimum physical or functional unit on which a unitasked job can run.

Remedial Maintenance (RM). That maintenance performed by the Contractor which results from Contractor-supplied equipment or operating software failure. It is performed as required and therefore on an unscheduled basis.

Terabyte (TB). Two (2) to the power of forty (40) bytes.

Teraword (TW). Two (2) to the power of forty (40) words.

Word. Sixty-four (64) bits.

SECTION D
PACKAGING AND MARKING

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D.1 PACKAGING
D.2 PACKING AND UNPACKING
D.3 CONTAINER MARKING

D.1 PACKAGING

The supplies shall be packaged in accordance with best commercial practice and in a manner that will afford protection against corrosion, deterioration and physical damage during direct shipment. This packing shall be such that shock and vibration incidental to shipping and handling will not affect the characteristics of factory settings of the components so as to ensure that field performance will be within specification tolerances after system installation and final adjustment. The supplies shall be packed in a manner conforming to the requirements of Uniform Freight Classification for rail shipment; National Motor Freight Classification for truck shipment; Parcel Post Regulations and the regulations of other carriers as applicable to the mode of transportation employed.

D.2 PACKING AND UNPACKING

The Contractor shall furnish such labor as may be necessary for packing, unpacking, and placement of equipment when in the possession of the Government without additional charge to the Government.

Supervision of packing, unpacking, and placement of the equipment shall be furnished by the Contractor without charge to the Government.

D.3 CONTAINER MARKING

Containers shall be clearly marked as follows:

1. Name of contractor
2. Contract no.
3. Description of items contained therein
4. Consignee's name and address

SECTION E - INSPECTION AND ACCEPTANCE

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E.1 CONTRACT CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2)(FEB 1998)
E.2 STANDARD OF PERFORMANCE AND ACCEPTANCE OF SYSTEM
E.3 DATE OF ACCEPTANCE
E.4 DELAY OF START OF PERFORMANCE PERIOD

E.1 CONTRACT CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this address: http://www.arnet.gov/far

CLAUSE NUMBER	DATE	TITLE
52.246-2	AUG 1996	INSPECTION OF SUPPLIES--FIXED PRICE
52.246-4	AUG 1996	INSPECTION OF SERVICES--FIXED PRICE
52.246-16	APR 1984	RESPONSIBILITY FOR SUPPLIES

E.2 STANDARD OF PERFORMANCE AND ACCEPTANCE OF SYSTEM

E.2.1 GENERAL

This clause establishes a standard of performance which must be met before any equipment or software delivered under this contract is accepted by the Government. This provision also includes replacement, substitute equipment, equipment upgrades, and equipment which is added or field-modified (modification of equipment from one model to another) after a successful performance period.

E.2.2 PERFORMANCE PERIOD

The performance period shall begin on the installation date (unless delayed in accordance

with E.4, “Delay of Start of Performance Period”) and shall end when the system has met the standard of performance for a period of thirty (30) consecutive days by operating in conformance with the Contractor’s technical specifications and functional descriptions, or as quoted in the Contractor’s proposal, which must satisfy the requirements of Section C, at an effectiveness level of 99% or more.

E.2.3 CONTINUANCE OF PERFORMANCE PERIOD
If the system does not meet the standard of performance during the initial 30 consecutive days, the performance period may continue subject to Section E.2.4, on a day-by-day basis until the standard of performance is met for a total of 30 consecutive days.

E.2.4 FAILURE TO MEET STANDARD OF PERFORMANCE
If the system fails to meet the standard of performance after 90 calendar days from the installation date or start of the performance period, whichever is later, the Government may at its option request a replacement or terminate the contract for default and request the immediate removal of the equipment and software.

E.2.5 EFFECTIVENESS LEVEL COMPUTATIONS
The effectiveness level for a system is computed by dividing the operational use time by the sum of the operational use time plus system failure downtime.

E.2.6 CHANGES IN EQUIPMENT
The effectiveness level for equipment added, upgraded, field-modified, or substituted, or for replacement equipment is a percentage figure determined by dividing the operational use time of the system by the sum of that time plus downtime resulting from system failure of the equipment/software being tested.

E.2.7 OPERATIONAL USE TIME FOR SYSTEM
Operational use time for performance testing for a system is the accumulated time during which the HPCS is in actual operation, including any intervals of time between the start and stop of processing of programs.

E.2.8 OPERATIONAL USE TIME FOR EQUIPMENT
Operational use time for performance testing of equipment added, upgraded, field-modified, or substituted, or for replacement equipment is defined as the accumulated time during which the equipment is in actual use.

E.2.9 SYSTEM FAILURE DOWNTIME
System failure downtime is that period of time during which all of the scheduled productive workload, or simulated workload, being used for acceptance testing, cannot be continued on the system due to failure. If simulated workload is being used, it must be consistent with the requirements set forth elsewhere in this contract.

E.2.10 START OF DOWNTIME
Downtime for each incident shall start from the time the Government reports the problem (or makes a bona-fide attempt to contact the Contractor's designated representative) until the system is returned to the Government in proper operating condition, exclusive of actual travel time required by the Contractor's maintenance personnel. However, at the request of the Contractor, the Government shall make available not only the failed equipment/software, but also equipment/software which the Contractor must access to accomplish such repairs. The Contractor shall provide an answering service or other continuous telephone coverage to permit the Government to make such contact.

E.2.11 EQUIPMENT USE DURING SYSTEM DOWNTIME
During a period of system failure downtime, the Government may use operable equipment when such action does not interfere with maintenance of the inoperable equipment/software. The entire system will be considered down during such periods of use. Whenever the operable equipment is not released to the Contractor upon request, all such usage periods shall be considered system operational use time in computing the effectiveness level.

E.2.12 MACHINE FAILURE DOWNTIME
Machine failure downtime for a machine added, field-modified, upgraded, or substituted, or for a replacement machine after the system has completed a successful performance period is that period of time when such machine is inoperable due to its failure.

E.2.13 MINIMUM OF USE TIME
During the performance period for a system/machine, a minimum of 100 hours of operational use time with scheduled productive or simulated work will be required as a basis for computing the effectiveness level. However, in computing the effectiveness level, the actual number of operational use hours shall be used when that number exceeds the minimum of 100 hours. Added equipment, upgraded equipment, field-modified equipment, and substitute equipment are subject to the 100 hour minimum use time requirement. However, the Government shall accept such equipment without the addition of simulated work solely to achieve the minimum of 100 hours use time, provided the average effectiveness for the 30-day acceptance period is equal to or better than the level specified in Paragraph E.2.2 "Performance Period".

E.2.14 DAILY RECORDS
The Government shall maintain appropriate daily records to satisfy the requirements of Section E.2 and shall notify the Contractor in writing of the date of successful completion of the performance period.

E.2.15 MEASURE OF OPERATIONAL USE TIME
Operational use time and downtime shall be measured in hours and whole minutes.

E.3 DATE OF ACCEPTANCE

Charges shall commence on the first day of the successful performance period. The Government shall not accept equipment and shall not pay charges until the standard of performance is met.

Upon successful completion of the 30-day performance test period, the Government will provide the Contractor with written notice of acceptance, identifying the actual date of acceptance and retroactively establishing the first day if the successful 30-day performance period.

E.4 DELAY OF START OF PERFORMANCE PERIOD

If necessary, the Government may delay the start of the performance period, but such a delay shall not exceed 30 consecutive days. Should the Government delay the start of the performance period, rental or maintenance charges shall accrue for that period of time between the installation date and the start of the performance period and shall be paid upon completion of the successful performance period.

SECTION F
DELIVERIES OR PERFORMANCE

F.1 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2)(FEB 1998)
F.2 TERM OF CONTRACT
F.3 DOWNTIME CREDITS
F.4 PLACE OF DELIVERIES/INSTALLATION
F.5 DELIVERY/INSTALLATION REQUIREMENTS
F.6 TIME OF DELIVERY

F.1 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2)(FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this address: http://www.arnet.gov/far

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

NUMBER	DATE	TITLE
52.242-15	AUG 1989	STOP-WORK ORDER
52.242-17	APR 1984	GOVERNMENT DELAY OF WORK
52.247-35	APR 1984	F.O.B. DESTINATION, WITHIN CONSIGNEE'S PREMISES

F.2 TERM OF CONTRACT

Although the Government contemplates use of the system (hardware and software) from date of acceptance until the end of FY2003, the term of this contract shall be a period from date of contract award through September 30, 2001. The Government currently has $2.9 million available for obligation to fund the term of the contract with the remainder subject to the availability of next fiscal year funds. In accordance with I.3, OPTION TO EXTEND THE TERM OF THE CONTRACT (FAR 52.217-7)(MAR 1989), the period of performance may be extended for (two) additional twelve-month periods which, if exercised, will extend the contract period of performance to the end of FY2003 (September 30, 2003). Furthermore, this contract includes an option (Option Contract Period) for a system enhancement which, if exercised, could extend the contract three additional years. The option contract period will be structured as a one- year base period with two additional annual options. If all options are exercised, the period of the contract will encompass seven years (FY2000-FY2006).

F.3 DOWNTIME CREDITS

Each computer in the Large Scale Cluster (LSC) shall meet the availability requirements cited in Section C.4.4.1.5, LSC reliability, availability, and support. Each computer in the Analysis Cluster (AC) shall meet the availability requirements cited in Section C.4.4.2.4, AC reliability, availability, and support. The Hierarchical Storage Management System (HSMS) shall meet the availability requirements cited in Section C.4.5.5, HSMS reliability, availability, and support. The Home Directory Filesystem Server (HFS) shall meet the availability requirements cited in Section C.4.6, Home Directory Filesystem Server (HFS). Failure to achieve the proposed throughput on the LSC or AC may require that the Contractor deliver new equipment to make up for the shortfall in throughput as cited in Section C.4.9.2, Availability. Failure to achieve the proposed availability levels on the HSMS and HFS may result in the assessment of downtime credits.

F.3.1 Definitions

System downtime is defined in Section C.4.9.1, Downtime.

During any month, the available time on a system is defined as the length of the month multiplied by the proposed availability level for that system.

F.3.2 Period of Downtime

Downtime credit shall begin accruing if the HSMS availability does not meet the criteria in Section C.4.5.5, HSMS reliability, availability, and support, or if the HFS availability does not meet the criteria in Section C.4.6, Home Directory Filesystem Server (HFS). HSMS and HFS system availability shall be determined monthly.

F.3.3 Credit for System Downtime

If the LSC remains inoperable and cannot perform the workload due to an equipment or software malfunction through no fault or negligence of the Government, beyond the availability requirements of Section C.4.4.1.5, downtime credits shall accrue at the option of the Government. If, during any given month, the LSC availability falls below the level specified in Section C.4.4.1.5, the Government shall pay a monthly lease amount for the LSC based upon the percentage of time the system was operational. For example, if the LSC was only operational 95% of the required available time during a specific month because of LSC downtime, the Government would pay the Contractor 95% of the monthly lease charge for the LSC.

If the AC remains inoperable and cannot perform the workload due to an equipment or software malfunction through no fault or negligence of the Government, beyond the availability requirements of Section C.4.4.2.4, downtime credits shall accrue at the option

of the Government. If, during any given month, the AC availability falls below the level specified in Section C.4.4.2.4, the Government shall pay a monthly lease amount for the AC based upon the percentage of time the system was operational. For example, if the AC was only operational 95% of the required available time during a specific month because of AC downtime, the Government would pay the Contractor 95% of the monthly lease charge for the AC.

If the HSMS remains inoperable and cannot perform the workload due to an equipment or software malfunction through no fault or negligence of the Government, beyond the availability requirements of Section C.4.5.5, downtime credits shall accrue. If, during any given month, the HSMS availability falls below the level specified in Section C.4.5.5, the Government shall (i) pay a reduced monthly lease amount for the HSMS, in the case of a lease, or (ii) be refunded a portion, to be negotiated, of the purchase price of the HSMS, in the case of a purchase, based upon the percentage of time the system was operational.

If the HFS remains inoperable and cannot perform the workload due to an equipment or software malfunction through no fault or negligence of the Government, beyond the availability requirements of Section C.4.6, downtime credits shall accrue. If, during any given month, the HFS availability falls below the level specified in Section C.4.6, the Government shall (i) pay a reduced monthly lease amount for the HFS, in the case of a lease, or (ii) be refunded a portion, to be negotiated, of the purchase price of the HFS, in the case of a purchase, based upon the percentage of time the system was operational.

F.4 PLACE OF DELIVERIES/INSTALLATIONS

The Contractor shall be responsible for transportation to, and installation of all hardware and software at the Government's site at the following address:

US Department of Commerce/NOAA/GFDL
Princeton University
Forrestal Campus, U.S. Route 1
Princeton, NJ 08542

F.5 DELIVERY/INSTALLATION REQUIREMENTS

The Government reserves the right to delay the installation by up to 30 days, at no additional cost to the Government, provided that:

a) the Contractor shall receive written notice from the Contracting Officer 30 days prior to the scheduled installation date.

b) Any installation delays beyond 30 days shall be mutually agreed to by the Contractor and the Government.

The Government shall provide the Contractor with access to the site for purposes of

installing the equipment prior to the scheduled installation date. The Contractor shall specify in writing in its proposal the time required for such access.

F.6 TIME OF DELIVERY

The initial system shall be delivered within 60 days after date of contract award.

SECTION G
CONTRACT ADMINISTRATIVE DATA

G.1 DESIGNATION OF CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE
G.2 CONTRACTING OFFICER'S AUTHORITY
G.3 CONTRACT MANAGEMENT
G.3.1 CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE
G.3.2 CONTRACTING OFFICER
G.4 INVOICE REQUIREMENTS
G.5 ADDITIONAL INVOICE REQUIREMENTS
G.6 REMITTANCE ADDRESS
G.7 PRICING OF ADJUSTMENTS

G.1 DESIGNATION OF CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE

This clause designates the Contracting Officer's Technical Representative (COTR) under this contract. A Contracting Officer may change the COTR at any time. The COTR under this contract is:

Name: TO BE DESIGNATED AT TIME OF AWARD
Address:

G.2 CONTRACTING OFFICER'S AUTHORITY

A Contracting Officer is the only person authorized to make or approve any changes in any of the requirements of this contract and notwithstanding any provisions contained elsewhere in this contract, the said authority remains solely in a Contracting Officer. In the event the Contractor makes any changes at the direction of any person other than a Contracting Officer, the change will be considered to have been made without authority and no adjustment will be made in the contract price to cover any increase in costs incurred as a result thereof.

G.3 CONTRACT MANAGEMENT

Notwithstanding the Contractor's responsibility for total contract management during performance, administration of the contract will require maximum coordination between the Government and the Contractor.

G.3.1 CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE

A Contracting Officer's Technical Representative (COTR) will be designated on authority of the Contracting Officer to monitor all technical aspects and assist in administration of the contract. The types of actions within the purview of the COTR's authority are to assure that the Contractor performs the technical requirements of the contract; to perform or cause to be performed inspections necessary in connection with performance of the contract; to maintain both written and oral communications with the Contractor concerning aspects of the contract within his purview; to issue written interpretations of technical requirements of Government drawings, designs, and specifications; to monitor the Contractor's performance under the contract and notify the Contractor and Contracting Officer of any deficiencies observed; and to coordinate Government furnished property availability and provide for site entry of Contractor personnel if required. A letter of designation will be issued to the COTR with a copy supplied to the Contractor, stating the responsibilities and limitations of the COTR. This letter will clarify to all parties to this contract the responsibilities of the COTR. At no time may the COTR effect changes to the contract which would result in a modification to the scope of work; changes in cost or price totals or estimates; changes in delivery dates; or changes in any other mutually-agreed upon term or provision of the contract.

G.3.2 CONTRACTING OFFICER

All contract administration will be effected by a Contracting Officer, address as shown on face page of this contract. Communications pertaining to contract administration matters will be addressed to the Contracting Officer. No changes in or deviation from the scope of work shall be effected without a Supplemental Agreement executed by a Contracting Officer authorizing such changes.

G.4 INVOICE REQUIREMENTS

(a) The Contractor shall submit invoices in triplicate directly to the Contracting Officer's Technical Representative (COTR) for attachment of a signed copy of the inspection report or for certification of receipt and acceptance on a copy of the contractor's bill. To constitute a proper invoice, the invoice must include, as a minimum, the following information and attached documentation:

1) Name of the business concern, invoice number and invoice date.

2) Contract number.

3) Description, price and quantity of goods and services actually delivered or rendered.

4) Shipping and payment terms.

5) Name (where practical), title, telephone number, and complete mailing address of responsible official to whom payment is to be sent.

6) Other substantiating documentation or information as required by the contract.

(b) To assist the Government in making timely payments, the Contractor is requested to furnish the following additional information either on the invoice or on an attachment to the invoice:

1) Date(s) that property was delivered or services rendered

2) Serial Numbers of property delivered

3) Address where property was delivered or services were rendered

4) Credits (if applicable)

G.5 ADDITIONAL INVOICE AND PAYMENT PROVISIONS

The Contractor shall render invoices (3 copies) for basic monthly charges at the end of the month for which the charges accrue. Payments for rental and services of less than one month's duration shall be prorated at 1/30th of the basic monthly charge for each calendar day.

Any credits due the Government may be applied against the Contractor's invoices with appropriate information attached.

G.6 REMITTANCE ADDRESS

Offeror shall indicate in the space provided below the address to which payment should be mailed if different from the Offeror's address:

_____

_____

_____

G.7 PRICING OF ADJUSTMENTS

When costs are a factor in any determination of contract price adjustment pursuant to the "Changes" clause or any other clauses of this contract, such costs shall be in accordance with the contract cost principles and procedures in Part 31 of the Federal Acquisition Regulation (48 CFR Part 31) in effect on the date of this contract.

SECTION H
SPECIAL CONTRACT REQUIREMENTS

H.1 UNAUTHORIZED INSTRUCTIONS FROM GOVERNMENT PERSONNEL
H.2 KEY PERSONNEL (CAR 1352.237-74) (JUL 1985)
H.3 NOTICE TO THE GOVERNMENT OF DELAYS
H.4 ENGINEERING CHANGES
H.5 CONTRACTOR COMMITMENTS, WARRANTIES AND REPRESENTATIONS (ADP 52.239-1286) (APR 1984)
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H.9 TECHNOLOGY SUBSTITUTION PLAN
H.10 SUBCONTRACT REPORTS (DOC)
H.11 SUBCONTRACTING PLAN APPROVAL
H.12 YEAR 2000-COMPLIANCE
H.13 PROPOSALS FOR THE CONTRACT OPTION PERIOD
H.14 INCURRED ELECTRICAL COSTS
H.15 LIQUIDATED DAMAGES

H.1 UNAUTHORIZED INSTRUCTIONS FROM GOVERNMENT PERSONNEL

a. The Contractor will not accept any instructions issued by any other person employed by the U.S. Government other than the Contracting Officer or the Contracting Officer's Technical Representative (COTR) acting within the limits of their authority.

b. No information, other than that which may be contained in an authorized modification to this contract will be considered as grounds for deviation from any stipulations of the contract's terms and conditions.

H.2 KEY PERSONNEL (CAR 1352.237-74) (JUL 1985)

a. The Contractor shall assign to this contract the following Key Personnel:

(to be completed at award)

b. During the first ninety (90) days of performance, the Contractor shall make no substitutions of key personnel unless the substitution is necessitated by illness, death, or termination of employment. The Contractor shall notify the Contracting

Officer within 15 calendar days after the occurrence of any of these events and provide the information required by paragraph c. below. After the initial 90-day period, the Contractor shall submit the information required by paragraph c. to the Contracting Officer at least 15 days prior to making any permanent substitutions.

c. The Contractor shall provide a detailed explanation of the circumstances necessitating the proposed substitutions, complete resumes for the proposed substitutes, and any additional information requested by the Contracting Officer. Proposed substitutes should have comparable qualifications to those of the persons being replaced. The Contracting Officer will notify the Contractor within 15 calendar days after receipt of all required information of the decision on substitutions.

H.3 NOTICE TO THE GOVERNMENT OF DELAYS

In the event the Contractor encounters difficulty in meeting performance requirements, or when it anticipates difficulty in complying with the contract delivery schedule or dates, or whenever the Contractor has knowledge that any actual or potential situation is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately notify the Contracting Officer and the COTR, in writing, giving pertinent details, provided, that this data shall be informational only in character and that this provision shall not be construed as a waiver by the Government of any delivery schedule or data or of any rights or remedies provided by law or under this contract.

H.4 ENGINEERING CHANGES

a. After contract award, the Government may solicit, and the Contractor is encouraged to propose, independently, engineering changes to the equipment, software specifications, or other requirements of this contract. These changes may be proposed to save money, to improve performance, to save energy, or to satisfy increased data processing requirements. If the proposed changes are acceptable to both parties, the Contractor shall submit a price change proposal to the Government for evaluation. Those proposed engineering changes that are acceptable to the Government will be processed as modifications to the contract.

b. This clause applies only to those proposed changes identified by the Contractor, as a proposal submitted pursuant to the provisions of this clause. As a minimum, the following information shall be submitted by the Contractor with each proposal:

1. A description of the difference between the existing contract requirement and the proposed change, and the comparative advantages and disadvantages of each;

2. Itemized requirements of the contract which must be changed if the proposal is adopted, and the proposed revision to the contract for each such change;

3. An estimate of the changes in performance and cost, if any, that will result from adoption of the proposal;

4. An evaluation of the effects the proposed change would have on collateral costs to the Government, such as Government-furnished property costs, costs of related items, and costs of maintenance and operation; and

5. A statement of the time by which the change order adopting the proposal must be issued so as to obtain the maximum benefits of the changes during the remainder of this contract. Also, any effect on the contract completion time or delivery schedule shall be identified.

c. Engineering change proposals submitted to the Contracting Officer shall be processed expeditiously. The Government shall not be liable for proposal preparation costs or any delay in acting upon any proposal submitted pursuant to this clause. The Contractor has the right to withdraw, in whole or in part, any engineering change proposal not accepted by the Government within the period specified in the engineering change proposal. The decision of the Contracting Officer as to the acceptance of any such proposal under this contract shall be final and shall not be subject to the "Disputes" clause of this contract.

d. The Contracting Officer may accept any engineering change proposal submitted pursuant to this clause by giving the Contractor written notice thereof. This written notice may be given by issuance of a modification to this contract. Unless and until a modification is executed to incorporate an engineering change proposal under this contract, the Contractor shall remain obligated to perform in accordance with the terms of the existing contract.

e. If an engineering change proposal submitted pursuant to this clause is accepted and applied to this contract, an equitable adjustment in the contract price and to any other affected provisions of this contract shall be made in accordance with this clause and other applicable clauses of this contract. When the cost of performance of this contract is increased or decreased as a result of the change, the equitable adjustment increasing or decreasing the contract price shall be in accordance with the "Changes" clause rather than under this clause, but the resulting contract modification shall state that it is made pursuant to this clause.

f. The Contractor is requested to identify specifically any information contained in the engineering change proposal which the Contractor considers confidential or proprietary and which the Contractor prefers not be disclosed to the public. The identification of information as confidential or proprietary is for informational

purposes only and shall not be binding on the Government to prevent disclosure of such information. Offerors are advised that such information may be subject to release upon request pursuant to the Freedom of Information Act. (5 U.S.C. 552).

H.5 CONTRACTOR COMMITMENTS, WARRANTIES AND REPRESENTATIONS (ADP 52.239-1286) (APR 1984)

Any written commitment by the Contractor within the scope of this contract shall be binding upon the Contractor. Failure of the Contractor to fulfill any such commitment shall render the Contractor liable for liquidated or other damages due to the Government under the terms of this contract. For the purpose of this contract, a written commitment by the Contractor is limited to the proposal submitted by the Contractor, and to specific written modifications to the proposal. Written commitments by the Contractor are further defined as including (1) any warranty or representation made by the Contractor in a proposal as to hardware or software performance; total systems performance; other physical, design, or functioning characteristics of a machine, software package, or system, or installation date; (2) any warranty or representation made by the Contractor concerning the characteristics or specifications accompanying or referred to in a proposal; and (3) any modification of or affirmation or representation relating to the above which is made by the Contractor in or during the course of negotiations, whether or not incorporated into a formal amendment to the proposal in question.

H.6 INSURANCE COVERAGE (CAR 1352.228-73) (JUL 1985)

Pursuant to the clause "Insurance - Work on a Government Installation (FAR 52.228-5)(JAN 1997)," the Contractor will be required to present evidence to show, as a minimum, the amounts of insurance coverage indicated below:

(a) Workers Compensation and Employer's Liability. The Contractor is required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when contract operations are so commingled with a Contractor's commercial operations that it would not be practical to require this coverage. Employer's liability coverage of at least $100,000 shall be required, except in States with exclusive or monopolistic funds that do not permit worker's compensation to be written by private carriers.

(b) General Liability. The Contractor shall have bodily injury liability insurance coverage written on the comprehensive form of policy of at least $500,000 per occurrence.

(c) Automobile Liability. The Contractor shall have automobile liability insurance written on the comprehensive form of policy. The policy shall provide for bodily injury and property damage liability covering the operation of all automobiles used in connection with performing the contract. Policies covering automobiles operated in the United States shall provide coverage of at least $200,000 per person and $500,000 per occurrence for bodily injury and $20,000 per occurrence for property damage.

(d) Aircraft Public and Passenger Liability. When aircraft are used in connection with performing the contract, the Contractor shall have aircraft public and passenger liability insurance. Coverage shall be at least $200,000 per person and $500,000 per occurrence for bodily injury, other than passenger liability, and $200,000 per occurrence for property damage. Coverage for passenger liability bodily injury shall be at least $200,000 multiplied by the number of seats or passengers, whichever is greater.

H.7 SITE PREPARATION

The Government shall prepare the site at its own expense and in accordance with the equipment environmental specifications furnished by the Contractor in their proposal except as specified otherwise in Section C, Statement of Need. Any alterations or modifications in site preparation which are directly attributed to incomplete or erroneous equipment environmental specifications provided by the Contractor which would involve additional expenses to the Government shall be made at the expense of the Contractor. Any delay in the installation date resulting from site alterations or modifications as specified in the paragraph above will not be charged to the Government. See Section C.4.10, FACILITIES DESCRIPTION AND REQUIREMENT, for detailed description and drawings of computer facility.

H.8 TECHNOLOGY SUBSTITUTION

H.8.1 OVERVIEW

All items (e.g., hardware, system applications software) and support services (maintenance, training, documentation, installation, and technical support services) shall be the most modern and cost-effective available at the time of delivery and installation. The contractor shall propose substitute items whenever the contractor or its subcontractor is offering replacement or substitutes for the components in question and the contractor offers the particular product to any of its commercial or Government customers. The Government may request that those items be substituted for comparable items originally offered. The Government reserves the right to accept or reject proposed substitutions.

H.8.1.1 MINIMUM QUALIFICATIONS FOR ACCEPTANCE OF SUBSTITUTIONS

a. The substitute item shall meet or exceed the applicable requirements and specifications of this contract.

b. Any substitute item shall be fully compatible with the existing hardware and software installed at the time the substitute is proposed for use.

c. The substitute item shall have capacity and performance characteristics equal to or better than those of the component it is to replace. The criteria used originally for selecting the winning vendor's components will be used to determine acceptability of substitute items.

d. The substitute item shall offer the same or increased functionality as the item it is to replace.

e. The price of the item shall be equal to or more cost-effective than the item it is to replace, based on the same evaluation as done under the solicitation.

H.8.1.2 TECHNOLOGY SUBSTITUTION MODIFICATION PROCEDURE

To propose a substitute item, the contractor shall submit a written proposal to the Contracting Officer, addressing each of the applicable specifications in Section C and any other attributes of the substitute item of which the Government should be aware. Additionally, the contractor agrees to demonstrate the proposed item prior to delivery, if requested by the Government.

H.8.1.3 BENEFIT TO THE GOVERNMENT

All proposed technology modifications, substitutions, and additions to the contract shall be evaluated as to their benefit to the Government. In determining the comparative life-cycle costs of such proposals, the performance costs over the remaining life of the contract shall be considered.

H.8.1.4 SUBMISSION OF PROPOSALS

No equipment shall be substituted until the contractor has submitted a proposal to the Contracting Officer with adequate supporting justification. Furthermore, an agreement between the Contracting Officer and the contractor must also be reached and authorized, by written modification to the contract, to effect such substitution. The Government may allow component substitutions when, in the opinion of the Contracting Officer, it is in the best interest of the Government to do so.

H.9 TECHNOLOGY SUBSTITUTION PLAN

a. The contractor is responsible for developing and maintaining, throughout the course of this contract, a technology substitution plan that conforms to Section H.8 and to the requirements in this section. This plan shall enable the contractor to propose, and the Government to consider, alternate hardware and software which meets the following characteristics:

1) Meets at a minimum all of the applicable mandatory requirements of the solicitation

2) Is functionally equivalent or superior to current items to be furnished under the contract

3) Will maintain or improve successful systems performance

4) Will facilitate or maintain ease of maintenance or use

5) Will be supportable for the life of the contract

6) Will provide a greater value to the Government than the hardware or software currently under contract.

b. Technology substitution specified in the plan and in Section H.8 is applicable only to hardware or software not yet installed at the time the improvement is authorized by the Government. Replacement of already-installed contractor hardware or software will be considered by the Government under the Engineering Change Proposal clause (H.4), should either the Government or the contractor so request.

c. Hardware or software installed pursuant to this clause shall be subject to the same warranties, maintenance credits, downtime credits, and acceptance procedures as items already under contract.

d. The contractor will be periodically evaluated on the quality of the technology substitution program, based upon the contractor's approved plan.

H.10 SUBCONTRACT REPORTS (DOC)

The Contractor shall submit subcontract reports in connection with performance of this contract; a report for subcontracting under this particular contract and a summary report when applicable (see paragraph b) on subcontracts in all contracts between the Contractor and the Department of Commerce which contain subcontract goals for awards to small business and small disadvantaged business concerns.

(a) The Contractor shall submit a subcontracting report for this contract on Standard Form 294 (Rev 12-98). The report shall be submitted semi-annually in accordance with the General Instructions on the reverse side of the form. The report shall be submitted to:

Distribution	Addressee
copy	Contracting Officer
original	U.S. Department of Commerce Office of Small and Disadvantaged Business Utilization 14th & Constitution Ave., N.W. HCHB, Room H-6411 Washington, D.C. 20230

(b) The Contractor shall submit a summary subcontract report on all of its contracts with the Department of Commerce which have subcontracting goals on Standard Form 295 (Rev 12-98). The report shall be submitted annually in accordance with the General Instructions on the reverse side of the form. The report shall be submitted no later than 15 days following the close of each reporting period. The report shall be submitted to:

Distribution	Addressee
copy	Contracting Officer
original	U.S. Department of Commerce Office of Small and Disadvantaged Business Utilization 14th & Constitution Ave., N.W. HCHB, Room H-6411 Washington, D.C. 20230

H.11 SUBCONTRACTING PLAN APPROVAL

The Subcontracting Plan submitted by _____*_____and dated ___*___ has been approved by the Government and is incorporated herein and made a part of this contract. Any modifications to this contract or modifications in excess of $500,000 ($1,000,000 for construction) will require modification of the Subcontracting Plan.

* To be completed at time of award

H.12 YEAR 2000-COMPLIANCE

The contractor warrants that each item of hardware, software, and firmware delivered or developed under this contract shall be able to accurately process date data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the year 1999 and 2000 and leap year calculations, when used in accordance with the item documentation provided by the contractor, provided that all items (e.g., hardware, software, firmware) used in combination with such listed item properly exchange date data with it. If the contract requires that specific listed items must perform as a system in accordance with the foregoing warranty, then that warranty shall apply to those listed items as a system. The duration of this warranty and the remedies available to the Government for breach of this warranty shall be as defined in, and subject to, the terms and limitations of any general warranty provisions of this contract, provided that notwithstanding any provision to the contrary in such warranty provision(s), or in the absence of any such warranty provision(s), the remedies available to the Government under this warranty shall include repair or replacement of any listed item whose non-compliance is discovered and made known to the contractor in writing within 180 days after acceptance. Nothing in this warranty shall be construed to limit any rights or remedies the Government may otherwise have under this contract with respect to defects other than Year 2000 performance.

H.13 PROPOSALS FOR THE CONTRACT OPTION PERIOD

The system life for the HPCS is projected to encompass seven years (FY2000-FY2006). The contract will be divided into a base period (FY2000-2003), followed by an option period (FY2004-2006). The decision to exercise the option period in FY2004 will be made by evaluating a proposal, submitted to the Government by the incumbent contractor no later than August 31, 2002. The HPCS proposed for the option period (FY2004-2006) must offer a guaranteed increase in computational performance over the system delivered as the final substantial upgrade during the contract base period. Exercise of the contract option period will be based on performance during the base contract period and a proposal submitted for contract option period effort. The contract option period proposal shall include, at a minimum, the information and documentation described in the following paragraphs.

A. TECHNICAL PROPOSAL

The technical proposal must include the following sections:

TAB 1. OVERVIEW - This Tab shall include the information as described in Section L.6.1, TAB 1. OVERVIEW of Solicitation 52-DDNR-0-90030.

TAB 2. LARGE SCALE CLUSTER - This Tab shall include the information as described in Section L.6.1, TAB 6. LARGE SALE CLUSTER (LSC) of Solicitation 52-DDNR-0-90030.

TAB 3. ANALYSIS CLUSTER - This Tab shall include the information as described in Section L.6.1, TAB 7 ANALYSIS CLUSTER (AC) of Solicitation 52-DDNR-0-90030.

TAB 4. BENCHMARK RESULTS - This Tab shall include the results from benchmark tests that the Contractor used as a basis for calculating the proposed performance levels on the LSC and AC. These benchmark tests, provided by the Government during FY2002, will consist of an LSC benchmark and an AC benchmark similar to the LSC and AC benchmarks provided with Solicitation 52-DDNR-0-90030, but of reduced scope.

B. COST PROPOSAL

The Contractor shall provide an overall price for the optional system that conforms to the funding profile cited in Section B, “Notes to Offerors”.

H.14 INCURRED ELECTRICAL COSTS

Because the Government has a fixed amount of funds to operate the new HPCS, it must have a mechanism to pay for any additional electric utility costs above what it currently

pays. Therefore, once the T932 and T3E systems are powered off, GFDL will require the Contractor to assume responsibility to pay the Laboratory's PSE&G electric utility bill beginning in any month in which the new equipment installed under this contract, plus the legacy T94 and StorageTek equipment and the remaining air conditioning equipment in the Computer Room have power requirements greater than 700 KVA. Subsequently, the Government will reimburse the Contractor for the cost of the Government's power usage up to 9,000,000 KwH per year, which will be prorated as required at the end of the contract. In no event will the Contractor be required to pay for power usage not associated with the operation and cooling of the equipment covered under this contract.

H.15 LIQUIDATED DAMAGES

The Government is responsible to pay continued lease, maintenance and support costs of the T932/T3E systems until acceptance of the HPCS has occurred. In order to compensate the Government for failure to deliver and install the system and promptly pass the acceptance testing, the Contractor shall be liable for liquidated damages commencing December 1, 2000, and continuing through April 1, 2001, at the rate of $302,000 per month (the amount of T932/T3E lease, maintenance and support costs) prorated on a daily basis. This proration shall be based upon a thirty day month. If the system is not ready for GFDL's use by April 1, 2001, the Contractor shall provide other computational resources as specified in Section C.4.1.

PART II - CONTRACT CLAUSES

SECTION I - CONTRACT CLAUSES

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I.1 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this address: http://www.arnet.gov/far

CLAUSE NUMBER	DATE	TITLE
52.202-1	OCT 1995	DEFINITIONS
52.203-3	APR 1984	GRATUITIES
52.203-5	APR 1984	COVENANT AGAINST CONTINGENT FEES
52.203-6	JUL 1995	RESTRICTIONS ON SUBCONTRACTOR SALES TO THE GOVERNMENT
52.203-7	JUL 1995	ANTI-KICKBACK PROCEDURES
52.203-8	JAN 1997	CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY
52.203-10	JAN 1997	PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY
52.203-12	JUN 1997	LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS
52.204-4	JUN 1996	PRINTING/COPYING DOUBLE SIDED ON RECYCLED PAPER
52.209-6	JUL 1995	PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT
52.211-5	OCT 1977	MATERIALS REQUIRED
52.215-2	JUN 1999	AUDIT AND RECORDS -- NEGOTIATION

CLAUSE NUMBER	DATE	TITLE
52.215-8	OCT 1997	ORDER OF PRECEDENCE –- UNIFORM CONTRACT FORMAT
52.215-11	OCT 1997	PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA –- MODIFICATIONS
52.215-13	OCT 1997	SUBCONTRACTOR COST OR PRICING DATA –- MODIFICATIONS
52.215-14	OCT 1997	INTEGRITY OF UNIT PRICES
52.215-15	DEC 1998	PENSION ADJUSTMENTS AND ASSET REVERSIONS
52.215-18	OCT 1997	REVERSION OR ADJUSTMENT OF PLANS FOR POST RETIREMENT BENEFITS OTHER THAN PENSIONS (PRB)
52.215-19	OCT 1997	NOTIFICATION OF OWNERSHIP CHANGES
52.215-21	OCT 1997	REQUIREMENTS FOR COST OR PRICING DATA OR INFORMATION OTHER THAN COST OR PRICING DATA –- MODIFICATIONS
52.219-8	OCT 1999	UTILIZATION OF SMALL BUSINESS CONCERNS
52.219-9	OCT 1999	SMALL BUSINESS SUBCONTRACTING PLAN ALTERNATE II (JAN 1999)
52.219-16	JAN 1999	LIQUIDATED DAMAGES –- SUBCONTRACTING PLAN
52.222-3	AUG 1996	CONVICT LABOR
52.222-21	FEB 1999	PROHIBITION OF SEGREGATED FACILITIES
52.222-26	FEB 1999	EQUAL OPPORTUNITY
52.222-35	APR 1998	AFFIRMATIVE ACTION FOR DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA
52.222-36	JUN 1998	AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES
52.222-37	JAN 1999	EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA
52.223-5	APR 1998	POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION
52.223-6	JAN 1997	DRUG-FREE WORKPLACE
52.223-14	OCT 1996	TOXIC CHEMICAL RELEASE REPORTING
52.225-5	FEB 2000	TRADE AGREEMENTS
52.225-8	FEB 2000	DUTY-FREE ENTRY
52.225-13	FEB 2000	RESTRICTIONS ON CERTAIN FOREIGN PURCHASES
52.227-1	JUL 1995	AUTHORIZATION AND CONSENT
52.227-2	AUG 1996	NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT
52.227-3	APR 1984	PATENT INDEMNITY
52.227-14	JUN 1987	RIGHTS IN DATA--GENERAL (ALTERNATE II [JUN 1987] AND III [JUN 1987])

CLAUSE NUMBER	DATE	TITLE
52.227-19	JUN 1987	COMMERCIAL COMPUTER SOFTWARE--RESTRICTED RIGHTS
52.228-5	JAN 1997	INSURANCE –- WORK ON A GOVERNMENT INSTALLATION
52.229-3	JAN 1991	FEDERAL, STATE, AND LOCAL TAXES
52.229-5	APR 1984	TAXES -- CONTRACTS PERFORMED IN U.S. POSSESSIONS OR PUERTO RICO
52.232-1	APR 1984	PAYMENTS
52.232-8	MAY 1997	DISCOUNTS FOR PROMPT PAYMENT
52.232-11	APR 1984	EXTRAS
52.232-17	JUN 1996	INTEREST
52.232-23	JAN 1986	ASSIGNMENT OF CLAIMS
52.232-25	JUN 1997	PROMPT PAYMENT
52.232-34	MAY 1999	PAYMENT BY ELECTRONIC FUNDS TRANSFER – OTHER THAN CENTRAL CONTRACTOR REGISTRATION
52.233-1	DEC 1998	DISPUTES (ALT I [DEC 1991])
52.233-3	AUG 1996	PROTEST AFTER AWARD
52.237-2	APR 1984	PROTECTION OF GOVERNMENT BUILDINGS, EQUIPMENT AND VEGETATION
52.242-13	JUL 1995	BANKRUPTCY
52.243-1	AUG 1987	CHANGES -- FIXED-PRICE
52.244-2	AUG 1998	SUBCONTRACTS
52.244-6	OCT 1998	SUBCONTRACTS FOR COMMERCIAL ITEMS AND COMMERCIAL COMPONENTS
52.245-2	DEC 1989	GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS)
52.248-1	FEB 2000	VALUE ENGINEERING
52.249-2	SEP 1996	TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE)
52.249-8	APR 1984	DEFAULT (FIXED-PRICE SUPPLY AND SERVICE)
52.253-1	JAN 1991	COMPUTER GENERATION OF FORMS BY THE PUBLIC

I.2 OPTION FOR INCREASED QUANTITY-SEPARATELY PRICED LINE ITEM (FAR 52.217-7) (MAR 1989)

The Government may require the delivery of the numbered line item, identified in the Schedule as an option item, in the quantity and at the price stated in the Schedule. The Contracting Officer may exercise the option by written notice to the Contractor at any time during the life of the contract. Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

I.3 OPTION TO EXTEND THE TERM OF THE CONTRACT (FAR 52.217-9) (NOV 1999)

(a) The Government may extend the term of this contract by written notice to the Contractor prior to expiration of the contract; provided that the Government gives the Contractor a preliminary written notice of its intent to extend at least 30 days before the contract expires. The preliminary notice does not commit the Government to an extension.
(b) If the Government exercises this option, the extended contract shall be considered to include this option provision.
(c) The total duration of this contract, including the exercise of any options under this clause, shall not exceed seven (7) years.

I.4 AVAILABILITY OF FUNDS FOR THE NEXT FISCAL YEAR (FAR 52.232-19) (APR 1984)

Funds are not presently available for performance under this contract beyond September 30, 2000. The Government's obligation for performance of this contract beyond that date is contingent upon the availability of appropriated funds from which payment for contract purposes can be made. No legal liability on the part of the Government for any payment may arise for performance beyond September 30, 2000, until funds are made available to the Contracting Officer for performance and until the Contractor receives notice of availability, to be confirmed in writing by the Contracting Officer.

PART III

SECTION J - LIST OF DOCUMENTS, EXHIBITS, AND OTHER ATTACHMENTS

J.1 RESERVED
J.2 PERFORMANCE EVALUATION REPORT OF CONTRACTOR (3 Pages)
J.3 BENCHMARK INSTRUCTIONS (23 Pages)
J.4 PRICING TABLES AND EXHIBITS (21 Pages)

TABLE A-1	Detailed Hardware/Software Cost Table
TABLE A-1M	Detailed Hardware/Software Maintenance Cost Table
TABLE A-2	Detailed Additional Items Cost Table
TABLE A-3.1	Lease Plan
TABLE A-3.2	Lease to Ownership Plan
TABLE A-3.3	Lease with Option to Purchase
TABLE A-3.4	Purchase Plan
TABLE A-4	Additional Items Cost Table by Month
TABLE A-5	Power, Cooling, and Floor Space Cost Table
TABLE B	Nominal Interest Rates

PAST PERFORMANCE EVALUATION QUESTIONNAIRE
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
ACQUISITION MANAGEMENT DIVISION

CONTRACT INFORMATION

a) Contractor: _____

b) Contract Number: _____

c) Type of Contract:
[ ] Negotiated or [ ] Sealed Bid [ ] Competitive or [ ] Non-Competitive

[ ] Fixed Price: type: _____ [ ] Cost: type: _____

d) Period of Performance: From: _____ To: _____

e) Initial Contract Value: _____ Final Contract Value: _____

f) Brief Description of Requirement: _____

_____

_____

g) Complexity of Effort (Check One): [ ] Difficult [ ] Routine

RATER INFORMATION

Please provide the information requested below to assist the NOAA in tracking responses and resolving conflicts. This information will be kept confidential.

Name: _____ Organization: _____

Telephone/FAX Nos: _____

Mailing Address: _____

_____

Position Title/Grade: _____

Length of Involvement in Contract: _____

Questionnaire Completion Date: _____

PAST PERFORMANCE EVALUATION REPORT OF CONTRACTOR
(Check Appropriate Box)

PERFORMANCE ELEMENTS *	OUTSTANDING	GOOD	ACCEPTABLE	MARGINAL	INADEQUATE	UNACCEPTABLE
1. Quality of Products or Services, Compliance with contract requirements, and technical excellence						
2. Timeliness of Performance						
3. Cost Control, Budget Restraint and Efficiency						
4. Customer Satisfaction at end of Service						
5. Business Relations, Effective Management, Effective Subcontracting Program						

Remarks on Entirely Favorable Performance: Provide data supporting this observation on separate page.

Remarks on Entirely Unfavorable Performance: Provide data supporting this observation on separate page.

***** Please refer to the attached page for Past Performance criteria for additional information on performance elements.

DEFINITIONS

ADJECTIVE RATING	DESCRIPTION
Unacceptable	Past performance is unacceptable
Inadequate	Past performance more negative than positive
Marginal	No or neutral past performance
Acceptable	Past performance acceptable, more positive than negative
Good	Past performance acceptable in all areas/superior (good or outstanding) in several areas
Outstanding	Past performance acceptable in all areas/superior (good or outstanding) in most areas

J.3 Benchmark Instructions

J.3.1 Overview

In order to be considered for award, Offerors must successfully complete the benchmarks described below. The benchmarks may be obtained by following the instructions at http://www.gfdl.gov/hpcs/RFI/gfdl_bench.html. Vendors that have already completed and submitted a Benchmark Software Agreement need not do so again.

The Offeror must provide in tar/gzip format the source code used and the requested verification output for all aspects of the benchmark, as described in Sections J.3.2.2.3, J.3.2.3.3, J.3.3.2 and J.3.3.3, on 100MB Zip disk or ISO-9660 CDROM. All written responses and spreadsheets called for in these sections must be returned with the RFP response in printed form and digitally on 100MB Zip disk or ISO-9660 CDROM.

J.3.1.1 Source Code Changes

The Offeror may make changes to the compilation process and run script as necessary to accommodate their particular compilation and runtime environment(s).

Additionally, the Offeror may make changes to source code. However the Government requires that its applications be able to run on many different types of machines. Source code changes that reduce portability increase the costs of software maintenance and upgrades across multiple architectures. Therefore, certain types of code changes are preferred while others are discouraged. For the purpose of evaluating offerings, source code changes are divided into 4 Classes:

A. Modifications required to make a model run correctly, consistent with ANSI standard FORTRAN90 and C

B. Modifications to the program parallel communication

C. Modifications consistent with ANSI standard FORTRAN90 and C

D. All other modifications

Class A modifications are those required to allow a benchmark to run to completion correctly if, without such changes to source code, the benchmark will "fail" either by exiting prior to completion or producing incorrect answers. Class A modifications do not include any changes to source code solely for performance.

Because there may be many causes for such changes (e.g. GFDL non-standard language usage within the application, work-arounds required for compiler bugs, etc), the Government cannot state categorically that such modifications will not be evaluated without some sort of risk factor assigned. Still, it is the Government's desire to consider such changes as "essentially unmodified" code with no negative impact on evaluation.

Among the types of "changes" which will be taken as Class A are:

- Use of commercially supported libraries which are bid as part of the offering that requires no changes to benchmark source code or introduction of wrapper subroutines

- Compiler command lines with performance-specific options including, but not limited to, automatic parallelization

- Automatic parallelization and multitasking mediated through the operating system

- Use of commercially available and supported source pre-processors which are bid as part of the offering.

Class B modifications are source code changes either to the MPP library (mpp.F90, mpp_io.F90 and mpp_domains.F90) or to the direct use of MPI within an application (as within the HIM application). This includes use of communication libraries other than MPI. Such changes are encouraged though maintenance of MPI will still be required.

Class C modifications are limited to those which do not reduce code portability and which remain consistent with ANSI standard FORTRAN90 and C (it is acknowledged that the codes as they exist may already contain some ANSI non-compliant features). Performance is important and the Government is interested in performance-enhancing code modifications. However, resources to implement and maintain such changes are limited. Thus while a risk assessment will be made of any such changes, they are encouraged.

Among the types of changes taken to be Class C are:

- Use of commercially supported libraries which are bid as part of the offering

- Use of compiler "directives" within the source

Class D modifications are all those changes to application source not included in Classes A, B, or C. Such modifications reduce code portability and tend to make development and maintenance more difficult and costly. **Class D modifications are very strongly discouraged**.

All acceptable changes must produce output consistent with the verification provided as described with each benchmark.

As described in the instructions below, baseline performance numbers comprised of only Class A modifications will be required. MPI will be the required communication library for this baseline where a communication library is employed. MPI (or any other communication library) is clearly not applicable for systems which use compiler or operating system mediated AUTOMATIC parallelization for the baseline benchmark.

Offerors wishing to make code changes for evaluation must submit complete performance numbers for the entire test suite containing the code changes IN ADDITION to the baseline numbers. Having satisfied the baseline requirement, the Offeror is free to mix classes of changes. Offerors are cautioned, however, that a set of performance numbers and the associated changes will be evaluated as a single entity and accepted or rejected as such.

While it is highly desirable, it is not required that the Offeror reach minimum performance requirements based on Class A changes alone. However, Offerors are again cautioned that source changes associated with a set of performance numbers are assessed risk as a single entity.

J.3.1.2 Performance Data

Gathering of performance data is targeted to a system equivalent to that offered for the initial delivery. In this vein, the Test Systems on which the benchmarks are run and for which performance data is reported should be as close possible to the initial offered system. In general, any component of a Test System which is not the component proposed for the initial offered system will require the Government to make a risk assessment. The reasons for assigning risk will be clearly stated to each Offeror in their evaluation.

Still, the Government acknowledges that it may not be possible to use the offered system for either the RFP response or the LTD. Therefore two scenarios are provided to allow Offerors to respond to the RFP. Note that each scenario carries its own level of risk assessment.

Scenario A

Risk Assessment: *low to medium risk*

The Offeror shall develop performance data for the RFP response on a Test System with not less than 25% of the proposed number of processing elements, 25% of the computational performance, and 25% of the application memory. Further, a system at least as capable shall be used in the LTD.

A variation of this scenario is one where the Offeror has access to a Test System fulfilling at least the "25% criteria" for the purposes of providing the RFP response data, but may not have access to such a system for the LTD. In this event, the Offeror will provide output from Test Systems with no less than 25% the number of processing elements, 25% the computational performance, and 25% application memory of the offered system. The Offeror will then run components of the benchmark on the systems which are available at LTD to verify aspects of the performance numbers provided.

In either case, for Test Systems less than 100% of the offered system, the Offeror shall define, document and demonstrate the scalability features which will allow the delivered system to meet the offered performance values of the full system at installation. Clearly the smaller the Test System and LTD systems the greater the need for extrapolation and the higher the associated risk. Conversely the level of risk assessed for this scenario declines as the Test System for which data is collected for RFP response AND demonstrated at LTD reaches 100% of the offered system. The burden of proof and

associated risk is increased when the LTD system is less than the Test System used for the RFP response.

It is the Offeror's responsibility to develop, document and explain the extrapolation methodology. This may require data not called out in this RFP. It is the Offeror's responsibility to define and provide this data. The Offeror must detail all aspects of the extrapolation methodology, the supporting data and the demonstration methodology in the RFP response. The offer may be judged non-compliant if the extrapolation or demonstration methodology or the supporting data is determined to be unsuitable.

Scenario B

Risk Assessment: *highest risk*

The Offeror may extrapolate performance of the delivered system entirely from Test Systems meeting less than the 25% criteria described in Scenario A. Similarly, the LTD would take place on systems meeting less than the 25% criteria.

As with Scenario A, it is the Offeror's responsibility to develop, document and explain the extrapolation methodology. This may require data not called out in this RFP. It is the Offeror's responsibility to define and provide this data. The Offeror must detail all aspects of the extrapolation methodology, the supporting data and the demonstration methodology in the RFP response.

While not wishing to exclude a priori Offerors in this situation, the Government is highly skeptical that responses developed under Scenario B can be found compliant. Offerors following this approach accept an exceptional burden of proof.

These two scenarios cover the RFP response and pre-award Live Test Demonstration (LTD) phases. The only acceptable post-award LTD will be to successfully run the entire throughput suite at the performance level proposed by the successful Offeror and as described by the Acceptance Criteria section of this document. **Note that the software and hardware system configuration for this post-award LTD is required to be the same as that proposed for the initial production configuration at GFDL.**

J.3.2 Large Scale Cluster (LSC) Benchmark

J.3.2.1 Overview

The LSC benchmark is comprised of 2 parts with the following goals:

i) Throughput Benchmark: A measurement of system performance under quasi-realistic GFDL workload and Offeror proposed runtime environment to be completed in a maximum wall clock time of 14400 seconds.

ii) Scaling Study: A measurement of application performance, scaling and resource requirements with respect to a given GFDL "experiment".

There are 3 applications (or 4 depending on how one counts; the FMS "bgrid" and FMS "spectral" may be viewed as separate applications utilizing the same infrastructure) and 14 experiments derived from these. The experiments will be tested as a throughput suite in i) and individually tested in ii). They are:

1. FMS Spectral Atmosphere T42L20 coupled to 2deg MOM3 ocean
2. FMS Spectral Atmosphere T42L20 coupled to 1deg MOM3 ocean
3. FMS Spectral Atmosphere T106L30
4. FMS Lo-resolution N45L20 coupled to 1deg MOM3 ocean
5. FMS Hi-resolution N90L30 coupled to 1deg MOM3 ocean
6. FMS Standard Atmosphere N45L160
7. FMS Development N30L40
8. FMS Atmosphere N30L40 with Tracers
9. FMS Hi-resolution N270L40 Atmosphere
10. MOM3 2deg L36 ocean
11. MOM3 1deg L50 ocean
12. MOM3 3deg L25 + tracers
13. MOM3 p5deg MESO
14. HIM p25deg MESO

All experiments are to be run in 64-bit, IEEE floating point precision.

The throughput suite has been constructed from a set of "job streams" which can be completed in the 360 - T90 processor equivalent hours available to the lab in a 12 hour period. The phrase “T90 processor equivalent” means the computational capability of a single processor on the GFDL T932 with respect to a given experiment segment, or the number of GFDL T3E processing elements (PEs) required to produce the equivalent performance. A "job stream" is the set of sequentially processed segments of a given experiment which completes in the 12 hours.

It is important to note that throughout the benchmark instructions, a one to one, though not necessarily static, mapping of application processes to physical, application processors is assumed. For architectures where this is not the case, it is incumbent upon the vendor to document the distinction between the number of application processes and application processors. In this context, "application processors" means those processors with some part of the GFDL application running on them. This does not include auxiliary processors who's role is to provide specific support functions (such as communications assists). Auxiliary processors do need to be documented as part of the system configuration.

Many of the jobs utilize input files, some of which are rather large restart files. Further, restart files as well as other output files are written by the jobs. It is highly desirable that the vendor test and demonstrate movement of these files from and to the data archive and the file system in which the experiment segment will be run as is performed by the scripts which accompany the individual

experiments. It is assumed that the data would be on the "spinning disk" portion of the archive (i.e. there is no intent that retrieval from tape storage be part of this benchmark). The Government is specifically interested in tests which move data through the same software and hardware interconnect between "archive" and "LSC" as will be proposed by the Offeror.

It is understood that an offered HSMS may transfer data directly between the HSMS nearline tier and LSC disk (i.e. does not require transferring data from archive staging disk to a runtime directory on the LSC). In this case, the Offeror clearly should not introduce artificial file transfers into the benchmark.

J.3.2.2 LSC Throughput Benchmark

J.3.2.2.1 General Comments

The Throughput Benchmark should be performed within the following framework.

The queuing and scheduling software being proposed for the installed system should be used for the Throughput Benchmark. The Government acknowledges that the details of queues and scheduling used at install and after will likely be an evolving process. Still, based on the description of lab processing activities as well as the job stream for the Throughput Benchmark, the Offeror should construct queues and scheduling which may be generalized to be used by GFDL at install. Queue and scheduling structures which appear to be specialized merely to optimize throughput of the particular job stream of the benchmark fail generality and will be penalized. It is incumbent upon the Offeror to convince the Government that the queue structures and scheduling used during this throughput test meet the requirements of generality and extensibility.

Operators may not intervene to specify or alter the number of processing elements on which a job is running. If a job is paused or migrated in any way by the (human) operator, a description of the reason why and what was done must be provided.

The Offeror must not forget to include the time required for the file staging and storage to archive disk in extrapolations to the offered system. The Offeror is reminded that the 14400 second maximum throughput time for this benchmark on the installed system includes all file transfers necessary to and from "archive disk" and "application runtime" file systems, but does not include retrieval of files from tape storage to "archive disk".

By way of definition, a "job stream" is defined as the set of job segments totaling 12 hours of T90 processor equivalent time which completes an experiment. For the Throughput Benchmark, there are a total of 31 "job streams" comprised of the 14 different experiments.

It should be understood that three job streams have been combined into a single experiment for HIM (that is, the total run length of HIM has been specified such that it would take 36-T90 equivalent processor hours to complete). This will require that HIM be run on a proportionately larger number of processors than other experiments. As each experiment has 2 segments, there are a total of 29x2=58

experiment segments to be run for the Throughput Benchmark. Each of the 2 experiment segments must be completed sequentially.

Segments within a job stream are constrained as follows. The only changes to the job script allowed between segment submission within a given job stream (*e.g*. a single MOM3 p5deg stream) are changes required for starting from a restart file after the run from the 0 time step has been completed (where applicable).

PE specification may be different BETWEEN streams of the same application. It is the PE specification WITHIN a stream which must remain invariant. In particular, the specification for the number of processing elements employed by the job may NOT be changed in either the script or on the submission command line between submissions within a stream. Also as mentioned above, the number of PEs may not be specified by operator intervention. This does not mean that a stream segment must run on the same number of processors for each submission. But it does imply that selection from a range or set of possible processor configurations for a given run must be specified within the job script and thereafter handled automatically by software.

The reasons for the constraints on specifying PEs within a job stream are as follows. Assuming that a given application will run on a range of PE configurations, scientists at GFDL will not know a priori the processor configuration on which to run a given job that will optimize turn-around time and resource utilization efficiency at the time the job finally starts. Therefore, the scientists will choose a PE configuration (or a range or set of PE configurations if the queuing software allows) at the time of submission which they feel meets their requirements for turn around time and resource utilization efficiency. This choice of PE configuration will remain fixed in subsequent job segments as they are automatically submitted by the previous job segment. It is one of the goals of the Throughput Benchmark to simulate this aspect of GFDL's batch production environment.

Jobs may be run from existing executables. Time for compilation and linking as will be seen by the user of the delivered system will be reported elsewhere.

J.3.2.2.2 Running the LSC Throughput Benchmark

The Offeror will submit all of the 29 experiment first segments to the test queuing system in the following order:

1) FMS Spectral Atmosphere T42L20 coupled to 2deg MOM3 ocean
2) FMS Spectral Atmosphere T42L20 coupled to 1deg MOM3 ocean
3) FMS Spectral Atmosphere T106L30
4) FMS Lo-resolution N45L20 coupled to 1deg MOM3 ocean
5) FMS Hi-resolution N90L30 coupled to 1deg MOM3 ocean
6) FMS Standard Atmosphere N45L160
7) FMS Development N30L40
8) FMS Atmosphere N30L40 with Tracers
9) FMS Hi-resolution N270L40 Atmosphere
10) MOM3 2deg L36 ocean

11) MOM3 1deg L50 ocean
12) MOM3 3deg L25 + tracers
13) MOM3 p5deg MESO
14) HIM p25deg MESO
15) FMS Spectral Atmosphere T42L20 coupled to 2deg MOM3 ocean
16) FMS Spectral Atmosphere T42L20 coupled to 1deg MOM3 ocean
17) FMS Spectral Atmosphere T106L30
18) FMS Lo-resolution N45L20 coupled to 1deg MOM3 ocean
19) FMS Hi-resolution N90L30 coupled to 1deg MOM3 ocean
20) FMS Standard Atmosphere N45L160
21) FMS Atmosphere N30L40 with Tracers
22) MOM3 p5deg MESO
23) FMS Spectral Atmosphere T42L20 coupled to 2deg MOM3 ocean
24) FMS Spectral Atmosphere T42L20 coupled to 1deg MOM3 ocean
25) FMS Lo-resolution N45L20 coupled to 1deg MOM3 ocean
26) FMS Hi-resolution N90L30 coupled to 1deg MOM3 ocean
27) FMS Standard Atmosphere N45L160
28) FMS Spectral Atmosphere T42L20 coupled to 2deg MOM3 ocean
29) FMS Lo-resolution N45L20 coupled to 1deg MOM3 ocean

This submission may itself be performed through a shell script. The next segment of a job stream will be submitted as part of the completion process of the segment which is running. The details of the submission scenario are described below.

The queuing system should be "live" and begin initiating jobs as they are submitted. The Government acknowledges that there may be start-up effects associated with flooding the queuing system with 29 jobs, but knows of no other reasonable way to assign a start time from which to measure the required 4 hour runtime maximum. The start time is measured from the time the first job is submitted (e.g., when the “Enter” key is pressed to execute the submission shell script).

It is desirable to run the Throughput Benchmark on a Test System that is as close to the offered system as possible. Offerors are cautioned that benchmark environments, procedures and methodologies which are judged by the Government to lack generality and/or extensibility for the lab will be penalized and run the risk of being rejected outright as non-compliant.

The details of the Throughput Benchmark job structure are as follows:

1. FMS Lo-resolution T42L20 coupled to 2deg MOM3 ocean

    a. 4 jobs of 2 segments each comprised of <# time units> per segment.
    b. Segment 1 of each job is started from input data.
    c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
    d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

NOTE: Because there are multiple streams of this job running over the same time domain, care must be taken that output from one stream does not overwrite that of another.

2. FMS Hi-resolution T42L20 coupled to 1deg MOM3 ocean

    a. 3 jobs of 2 segments each comprised of <# time units> per segment.
    b. Segment 1 of each job is started from input data.
    c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
    d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

NOTE: Because there are multiple streams of this job running over the same time domain, care must be taken that output from one stream does not overwrite that of another.

3. FMS Spectral Atmosphere T106L30

    a. 2 jobs of 2 segments each comprised of <# time units> per segment.
    b. Segment 1 of each job is started from input data.
    c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
    d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

NOTE: Because there are multiple streams of this job running over the same time domain, care must be taken that output from one stream does not overwrite that of another.

4. FMS Lo-resolution N45L20 coupled to 1deg MOM3 ocean

    a. 4 jobs of 2 segments each comprised of <# time units> per segment.
    b. Segment 1 of each job is started from input data.
    c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
    d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

NOTE: Because there are multiple streams of this job running over the same time domain, care must be taken that output from one stream does not overwrite that of another.

5. FMS Hi-resolution N90L30 coupled to 1deg MOM3 ocean

    a. 3 jobs of 2 segments each comprised of <# time units> per segment.
    b. Segment 1 of each job is started from input data.
    c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.

d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

NOTE: Because there are multiple streams of this job running over the same time domain, care must be taken that output from one stream does not overwrite that of another.

6. FMS Standard Atmosphere N45L160

a. 3 jobs of 2 segments each comprised of 45 hours per segment: (time_units=hours; trun_length=45)
b. Segment 1 of each job is started from input data.
c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

NOTE: Because there are multiple streams of this job running over the same time domain, care must be taken that output from one stream does not overwrite that of another.

7. FMS Development N30L40

a. 1 job of 2 segments comprised of 17 days per segment: (time_units=days; trun_length=17)
b. Segment 1 of the job is started from input data.
c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

8. FMS Atmosphere N30L40 with Tracers

a. 2 jobs of 2 segments each comprised of 17 days per segment: (time_units=days; trun_length=17)
b. Segment 1 of each job is started from input data.
c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

NOTE: Because there are multiple streams of this job running over the same time domain, care must be taken that output from one stream does not overwrite that of another.

9. FMS Hi-resolution N270L40 Atmosphere

a. 1 job of 2 segments comprised of 69 minutes per segment: (time_units=minutes; trun_length=69)
b. Segment 1 of the job is started from input data.
c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
d. Segment 2 is simply a re-run of segment 1.

10. MOM3 1deg L50 ocean

a. 1 job of 2 segments comprised of 10.5 days per segment: (days=10.0, diag=10.0)
b. Segment 1 of the job is started from input data (initial=true).
c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1 (initial=false)

11. MOM3 2deg L36 ocean

a. 1 job of 2 segments comprised of 180 days per segment: (days=180.0, diag=180.0)
b. Segment 1 of the job is started from input data at t=0 (initial=true).
c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1 (initial=false).

12. MOM3 3deg L25 + tracers

a. 1 job of 2 segments comprised of 1800 days per segment: (days=1800.0, diag=1800.0)
b. Segment 1 of the job is started from input data at t=0 (initial=true).
c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1 (initial=false).

13. MOM3 p5deg MESO

a. 2 jobs of 2 segments each comprised of 45 days per segment: (days=45.0, diag=45.0)
b. Segment 1 of each job is started from input data at t=0 (initial=true).
c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1 (initial=false).

NOTE: Because there are multiple streams of this job running over the same time domain, care must be taken that output from one stream does not overwrite that of another.

14. HIM p25deg MESO

    a. 1 job of 2 segments comprised of 2592 time steps per segment.
    b. Segment 1 of the job is started from input data at t=0 (initial=true).
    c. After "storage" of all output files to archive disk, the segment 1 run script should submit the script for segment 2.
    d. Segment 2 is run from the input data and the restart file generated by the successful completion of segment 1.

NOTE: Three of the job streams have been combined into a single experiment for HIM (that is the total run length of HIM has been specified such that it would take 36-T90 equivalent processor hours to complete). This will require that HIM be run on a proportionately larger number of processors than other experiments in the job mix. As each experiment has 2 segments, there are a total of 29x2=58 experiment segments to be run for the Throughput Benchmark.

As per section J.3.1.1, Source Code Changes, the baseline measurements required of all compliant offers must be made with only Class A modifications using MPI as the message passing library for those systems employing an explicit message communication library in the benchmark. Any extrapolations of values from Test Systems to the "baseline" performance of the offered system must be based on this data.

As further described in section J.3.1.1, the Offeror may supply additional measurements and extrapolations based on any combination of Class A, B, C, or D modifications. But as noted, such a data set is accepted and assessed risk, or rejected, as a whole. The Government will not attempt to selectively assess modifications associated with a given data set.

J.3.2.2.3 LSC Throughput Benchmark Output

The Offeror shall keep the responses to this section focused on the technical and engineering aspects of the benchmark data as pertains to their proposed solutions. Appropriate data includes CONCISE descriptions of Test System configuration and extrapolation and demonstration methodologies. References to competitors or other aspects of the general computing market place are NOT appropriate material for this section.

1. Provide a complete, concise description of the system configuration used for the Throughput Benchmark. Be sure to include:

    A. the queues and scheduling used to run the Throughput Benchmark
    B. the job submission {environment, process and command lines}
    C. all system operator activity during the runtime of the benchmark
    D. the number of PEs on the Test System
    E. the PE characteristics (e.g. processor cycle time and peak performance)
    F. the cache configuration of each PE
    G. the total and application memory available to each PE
    H. the “communication fabric” of the system (where applicable)

I. the hardware and software supporting the file system(s) for the benchmark
J. how the archive disk is being simulated for the benchmark

2. Provide a complete, concise description of the data gathering procedures and the data gathered and the extrapolation methodology used. All timings are to be presented in whole units of seconds. Fractional timings which are less than 0.5 shall be rounded “down” to the nearest integer; timings which are greater than or equal to 0.5 shall be rounded “up” to the nearest integer.

3. With respect to the data provided in 1., how will the installed system differ from the Test System used for the RFP response? How does the data provided and the extrapolations from the Test System show that the installed system will perform as offered?

4. The file “LSC_Benchmarks.xls” has been distributed with the benchmark codes. In this file, an Excel 97 Throughput spreadsheet template has been provided for the Throughput Benchmark. One spreadsheet must be completed for each of the following cases:

   A. Running the Throughput Benchmark on the Test System with Class A modifications
   B. Running the Throughput Benchmark on the Test System with Class A-D modifications, if distinct from A.
   C. Running the Throughput Benchmark on the Offered system with Class A modifications, if distinct from A.
   D. Running the Throughput Benchmark on the Offered system with Class A-D modifications, if distinct from C.

5. Please return all verification files, cited in each benchmark’s README file, that were produced on the Test System during the execution of the Throughput Benchmark.

The Government requires the following data be recorded in the Throughput spreadsheet for each experiment segment:

Column Heading	Definition
#PE	The number of PEs employed for the run
Run WCT	The wall clock time (WCT) from initiation to termination of the segment run script
Seg WCT	The WCT required from program invocation to program end for the segment
Agg CPU	The aggregate CPU time (user + system) used by the program
Agg Mem Use	The aggregate memory "highwater" mark
PE Mem Use	The per PE memory "highwater" mark

At the top of each spreadsheet, the end-to-end throughput wall clock time must be filled in.

J.3.2.3 LSC Scaling Study

J.3.2.3.1 General Comments

The goal of the Scaling Study is to measure individual application performance, scaling and resource requirements. Descriptions of the individual benchmark experiments are provided with each of the benchmark codes. See the README files included with the benchmark source for details. **Data for the Scaling Study should be collected using the same Test System that was used for the Throughput Benchmark**.

Applications should be run on as few processing elements as practical for the given experiment and should be scaled to as many PEs as possible. It is clear that at some number of PEs, the performance improvement of an application with respect to a particular experiment may flatten and perhaps decline. Termed a performance "rollover" point of the scaling curve, the Government requires data and documentation up to and including this point for all of the experiments.

The Government requires scaling data to 50% of the PEs on the offered system for the following experiments regardless of the presence of rollover points in the scaling curve:

9. FMS Hi-resolution N270L40 Atmosphere
14. HIM p25deg MESO

There may be multiple rollover points in the scaling curves for these experiments. Offerors may provide data beyond the first rollover point for other experiments at their discretion.

J.3.2.3.2 Running the LSC Scaling Study

In order to obtain a reasonable understanding of the scaling curve, the Government requires the following minimum number of performance data points for each experiment:

#	Experiment	Description	# data points
1	FMS Spectral Atmosphere T42L20 coupled to 2deg MOM3 ocean	1st segment for <#> time steps	5
2	FMS Spectral Atmosphere T42L20 coupled to 1deg MOM3 ocean	1st segment for <#> time steps	5
3	FMS Spectral Atmosphere T106L30	1st segment; (time_units=hours; trun_length=3)	5
4	FMS Lo-resolution N45L20 coupled to 1deg MOM3 ocean	1st segment for <#> time steps	5
5	FMS Hi-resolution N90L30 coupled to 1deg MOM3 ocean	1st segment for <#> time steps	5

#	Experiment	Description	# data points
6	FMS Standard Atmosphere N45L160	1st segment; (time_units=minutes; trun_length=450)	5
7	FMS Development N30L40	1st segment; (time_units=hours; trun_length=68)	4
8	FMS Atmosphere N30L40 with Tracers	1st segment; (time_units=hours; trun_length=68)	4
9	FMS Hi-resolution N270L40 Atmosphere	1st segment; (time_units=minutes; trun_length=12)	6
10	MOM3 1deg L50 ocean	1st segment; (days=1.75, diag=1.75)	5
11	MOM3 2deg L36 ocean	1st segment; (days=30.0, diag=30.0)	5
12	MOM3 3deg L25 + tracers	1st segment; (days=300.0, diag=300.0)	4
13	MOM3 p5deg MESO	1st segment; (days=7.5, diag=7.5)	5
14	HIM p25deg MESO	1st segment for 144 time steps	6

Run scripts for the scaling studies have been provided with the source code.

The Government requires that at least one of the data points be "reasonably close" (i.e. plus or minus 10%) to 1/30 of the proposed number of application PEs for the LSC for experiments 1-13 and 1/10 for experiment 14. It is acknowledged that experiment 12 is likely to scale poorly at 1/30 of the application PEs.

Data points should be provided at reasonable intervals between the minimum number of processors used and the maximum. As an example, a requirement for "6 data points" in an experiment which needs to span "minimum practical number of PEs" to "50% of the offered sytem" on a system with 1024 application PEs might look something like the set {16,32,64,128,256,512}. Offerors are encouraged to use processor configurations taking advantage of a "load balanced" number of PEs where this proves advantageous. Offerors are free to provide more data points at their discretion.

As per section J.3.1.1, Source Code Changes, the baseline measurements required of all compliant offers must be made with only Class A modifications using MPI as the message passing library for those systems employing an explicit message communication library in the benchmark. Any extrapolations of values from Test Systems to the "baseline" performance of the offered system must be based on this data.

As further described in section J.3.1.1, the Offeror may supply additional measurements and extrapolations based on any combination of Class A, B, C, or D modifications. But as noted, such a data set is accepted and assessed risk, or rejected, as a whole. The Government will not attempt to selectively assess modifications associated with a given data set.

J.3.2.3.3 LSC Scaling Study Output

The data to be gathered and returned with the Scaling Study benchmark is as follows:

1. Provide a complete, concise description of the system configuration used for the Scaling Study if different from the Test System used for the Throughput Benchmark. Be sure to include:

   A. the job submission {environment, process and command lines}
   B. the number of PEs on the Test System
   C. the PE characteristics (e.g. processor cycle time and peak performance)
   D. the cache configuration of each PE
   E. the total and application memory available to each PE
   F. the “communication fabric” of the system (where applicable)
   G. the hardware and software supporting the file system(s) for the benchmark
   H. how the archive disk is being simulated for the benchmark

2. Provide a complete, concise description of the data gathering procedures and the data gathered and the extrapolation methodology used. All timings are to be presented in whole units of seconds. Fractional timings which are less than 0.5 shall be rounded “down” to the nearest integer; timings which are greater than or equal to 0.5 shall be rounded “up” to the nearest integer.

3. With respect to the data provided in 1., how will the installed system differ from the Test System used for the RFP response? How does the data provided and the extrapolations from the Test System show that the installed system will perform as offered?

4. The file “LSC_Benchmarks.xls” has been distributed with the benchmark codes. In this file, an Excel 97 Scaling Study spreadsheet template has been. One spreadsheet must be completed for each of the following cases:

   A. Running the Scaling Study on the Test System with Class A modifications
   B. Running the Scaling Study on the Test System with Class A-D modifications, if distinct from A.
   C. Running the Scaling Study on the Offered system with Class A modifications, if distinct from A.
   D. Running the Scaling Study on the Offered system with Class A-D modifications, if distinct from C.

   Items to be completed in the spreadsheet include:

      i. The time required to compile and link the application
      ii. The number of PEs employed for the run
      iii. The wall clock time from initiation to termination of the experiment run script
      iv. The wall clock time required from program invocation to program end for the experiment

v. The aggregate CPU time used by the program
vi. The per PE and aggregate memory "highwater" mark.

5. Please return all verification files, cited in each benchmark's README file, that were produced on the Test System during the execution of the Scaling Study.

J.3.3. ANALYSIS CLUSTER (AC) BENCHMARK

J.3.3.1 Overview

The AC benchmark is comprised of 2 parts with the following goals:

i) Throughput Benchmark: A measurement of system performance under quasi-realistic GFDL workload and Offeror proposed runtime environment.

il) Contention-Free Study: A measurement of individual application performance and resource requirements

There are 8 applications comprising the AC benchmark:

1. BASIN precipitation analysis
2. EOF Case_2 calculation
3. SEASONAL postprocessing of climate integrations
4. LAN Analysis
5. LBL Line-by-Line radiation code
6. NC_COMBINE netcdf file combination
7. FMS Development N30L40
8. MOM3 3deg L25

These include unitasked applications as well as small parallel development codes (applications 7 and 8,whose source code has been distributed with the LSC benchmark) that users may wish to run on small (2-8) numbers of processors.

All experiments are to be run in 64-bit, IEEE floating point precision.

As with the LSC benchmark, the scenarios for RFP response and LTD systems apply. Similarly, the only acceptable post-award LTD will be to successfully run the entire throughput suite at the performance level proposed by the successful Offeror and as described by the Acceptance Criteria section of this document.

The Offeror may make changes to the application compilation and run scripts as necessary to accommodate their particular compilation and runtime environment(s).

Additionally, the Offeror may make changes to the source code. The same comments and classification scheme as described in Section J.3.1.1 applies to the AC benchmarks.

All requirements with regard to baseline performance measurements and evaluation of Class A modifications and Class A-D modifications are the same as for the LSC benchmarks as described in Section J.3.2.2 and will not be repeated here. Offerors are advised to review those instructions to ensure consistency between AC and LSC data.

Gathering of performance data is targeted to a system equivalent to that offered for the initial delivery. In this vein, it is highly desirable that the Test Systems used to provide performance numbers for the RFP response and the LTD be as close to the offered system as possible.

Still, the Government acknowledges that it may not be possible to use the offered system for either the RFP response or the LTD. See Section J.3.1.2. for details concerning RFP Test Systems and LTD systems.

J.3.3.2 AC Throughput Benchmark

All of the constraints for the LSC Throughput Benchmark apply to the AC Throughput Benchmark. A review of the constraints in Section J.3.2.2 would be prudent.

The AC Throughput Benchmark is comprised of a total of 22 job streams using the following number of job streams for each application (all job streams have one segment per stream):

1. BASIN precipitation analysis - 2 jobs
2. EOF calculation - 3 jobs
3. SEASONAL postprocessing of climate integrations - 1 job
4. LAN Analysis - 2 jobs
5. LBL Line-by-Line radiation code - 2 jobs
6. NC_COMBINE netcdf file combination - 5 jobs
7. FMS Development N30L40 - 3 jobs
8. MOM3 3deg L25 - 4 jobs

NOTE: When there are multiple streams of a job running at the same time, care must be taken that output from one stream does not overwrite that of another.

The small parallel applications (applications 7 and 8) should be run on 2 to 8 processors. Offerors should use resources adequate to produce performance consistent with that of the offered system.

The instructions for running the AC Throughput Benchmark are the same as for the LSC Throughput Benchmark described in Section J.3.2.2. All jobs in the AC throughput stream should be submitted to a "live" queuing system. Timing begins from submission of the first job. Although there is no specified time within which the AC Throughput Benchmark must complete, shorter completion times for the AC Throughput Benchmark will receive higher ratings in the evaluation.

The data to be gathered and returned for the AC Throughput Benchmark are identical to those to be gathered and returned for the LSC Throughput Benchmark, except the Throughput spreadsheet

template to be used is found in the Excel 97 file “AC_Benchmarks.xls”, which has been distributed with the benchmark codes.

J.3.3.3 AC Contention-Free Performance Study

Descriptions of the individual benchmark experiments are provided with each of the benchmark codes. See the README files included with the benchmark source for details.

The goal of running the AC benchmark codes individually is to measure contention free application performance and resource requirements. Scaling of the parallel applications

7. FMS Development N30L40
8. MOM3 3deg L25

is not an issue. These jobs should be run on the same number of processors used for the jobs in the AC Throughput Benchmark.

The data to be gathered and returned for the AC Contention-Free Study are identical to those to be gathered and returned for the LSC Scaling Study, except the Contention-Free spreadsheet template to be used is found in the Excel 97 file “AC_Benchmarks.xls”, which has been distributed with the benchmark codes.

J.3.4. HIERARCHICAL STORAGE MANAGEMENT SYSTEM (HSMS) ARCHIVE BENCHMARK

J.3.4.1 Overview

The HSMS archive benchmark measures the sustained throughput for moving files between Analysis Cluster (AC) local scratch filesystem(s) and the HSMS.

The pre-award archive benchmark is designed to measure the performance of the network and protocols, or other interconnect, used to move files between the HSMS and the AC. Disk-to-disk file transfers are done between the AC and a computer which represents the HSMS. The complete HSMS software need not be used, but file transfer and filesystem software should be as close as possible to the offered system.

At installation, the archive benchmark must be run using the complete HSMS, including the nearline tier robotic library, under control of the HSMS software.

Both the pre-award and installation benchmarks must be run concurrently with the AC Throughput Benchmark and must complete in no more than 3600 seconds of wallclock time.

J.3.4.2 Running the Archive Benchmark

The archive benchmark is defined by (1) and (2) below. Approximately 48 dGB of data must be moved (24 dGB each way). In the pre-award benchmark, "the HSMS" means disk storage on a computer

which represents the HSMS. In the installation benchmark, "the HSMS" means HSMS nearline tier tape storage as specified below. The AC local scratch filesystem(s) used must conform to the AC filesystem configuration proposed for production use.

(1) Move the specified number of copies of the files in the table below from the HSMS to AC local scratch filesystem(s):

(2) Move the specified number of copies of the files in the table below from AC local scratch filesystem(s) to the HSMS:

# copies	file size (dMB)	file
80	108	BASIN/archive/input/v2.precip.beta.1901_2000.unf3
20	783	LAN/archive/input/rthrm144

The files in the above table are analysis benchmark input files included in the analysis benchmark distribution. The requested copies should be prepared by running the provided "make_archive_files" script. This script creates files for the benchmark which follow an easily understood naming convention.

File transfers may be distributed over any combination of interactive and/or batch AC nodes. Batch nodes may be used without involvement of the batch queuing software. One possible implementation is a driver script run on one node which uses remote-shell commands to execute file transfers on several other nodes. The provided "run_in_parallel" script serves as an example driver script.

The benchmark execution time must be determined to the nearest second from "date" command output, AC process accounting reports, HSMS software log files, or other system timestamps.

In the installation benchmark, if tape technologies intended for small or large files are proposed, the 108 dMB files must be treated as small files, and the 783 dMB files must be treated as large files.

In the installation benchmark, for the files in (1) above which originate on HSMS tape storage, each file must reside on a separate tape volume. During setup of the installation benchmark, offerors must use administrator commands or other means to direct these files to separate tape volumes.

In the installation benchmark, execution time must include completion of writes to HSMS tape media. Also, the HSMS disk cache or staging filesystem must be cleared before running the benchmark, so that the files in (1) above are read entirely from tape storage.

J.3.4.3 Offeror Response

Offerors must provide written responses to the instructions below. In the technical proposal, respond for the pre-award benchmark only. At installation, respond for the installation benchmark. Reproduce each instruction above the response given.

1. Describe the hardware and software configuration used to run the benchmark, including file transfer and filesystem software.

2. Describe the distribution of the file transfers over the AC nodes. How does this differ from normal production use of the AC?

3. Give the benchmark execution time in seconds.

J.3.5 Legacy Archive Benchmark

J.3.5.1 Overview

The legacy archive benchmark measures the sustained throughput for moving files from the legacy archive to Analysis Cluster (AC) local scratch filesystem(s).

The legacy archive benchmark will be run stand-alone on the Analysis Cluster (AC) configured for production use. No other workload is run concurrently with this benchmark.

Throughout the base contract period, this benchmark must complete in no more than 1800 seconds of wallclock time. Higher levels of performance will not be given credit when evaluating proposals.

J.3.5.2 Running the Legacy Archive Benchmark

The legacy archive benchmark is defined by (3) below. Approximately 4.8 dGB of data must be moved from the legacy archive to AC local scratch filesystems(s).

(3) Move the files specified below from the legacy archive to AC local scratch filesystem(s):

# files	file size (dMB)	file names
32	50	legacy.S.01, ... legacy.S.32
4	783	legacy.L.01, ... legacy.L.04

These benchmark files will be prepared in the production legacy archive before HPCS installation. The 783 dMB files will be on 50 GB Redwood tapes, and the 50 dMB files will be on Timberline tapes. Each file will likely reside on a separate tape volume.

File transfers may be distributed over any combination of interactive and/or batch AC nodes. Batch nodes may be used without involvement of the batch queuing software. One possible implementation is a driver script run on one node which uses remote-shell commands to execute file transfers on several other nodes. The provided "run_in_parallel" script serves as an example driver script.

The benchmark execution time must be determined to the nearest second from "date" command output, AC process accounting reports, or other system timestamps.

The legacy archive disk cache or staging filesystem must be cleared before running the benchmark, so that the files in (3) above are read entirely from tape storage.

J.4 PRICING TABLES

TABLE A-1 . . . . . Detailed Hardware/Software Cost Table
TABLE A-1M . . . Detailed Hardware/Software Maintenance Cost Table

TABLE A-2 . . . . . Detailed Additional Items Cost Table

TABLE A-3.1 . . . Lease Plan
TABLE A-3.2 . . . Lease to Ownership Plan
TABLE A-3.3 . . . Lease with Option to Purchase
TABLE A-3.4 . . . Purchase Plan

TABLE A-4 . . . . . Additional Items Cost Table by Month
TABLE A-5 . . . . . Power, Cooling, and Floor Space Cost Table

TABLE B . . . . . Nominal Discount Factors

TABLE A-1
DETAILED HARDWARE/SOFTWARE COST TABLE

INSTRUCTIONS - this table provides detailed cost data on the basic charges for each item, either hardware or software, that the Offeror proposes.

Below is an explanation of the items listed in Cost Table A-1.

a. CLIN - Contract Line Item Number

b. Model Number - the manufacturer's identification number for each item proposed.

c. Description - enter a descriptive title of the item.

d. Purchase Price - the unit purchase price of each item proposed.

e. Monthly Rental - the monthly rental of each item proposed (without maintenance).

f. Monthly Lease Payments - the monthly lease with purchase option payments to be made for each item proposed (without maintenance).

g. Credits Accrued (for months) - compute the total purchase option credits accrued for each item proposed). Show the percent purchase option allowance and attach any terms and conditions; all must meet the contractual requirements of the Solicitation Document. Purchase option credits greater than 100 percent of monthly lease charges will not be considered in evaluating offers for award.

h. Amount Required to Exercise Purchase Option - The net difference between the Purchase (column D) less the Credits Accrued (column F.)

i. Lease to Ownership Amount of Balanced Monthly Payment - Enter the balanced monthly lease rate (without maintenance) which must be paid in order for the Government to obtain ownership upon the payment of the final monthly lease payment under this plan (with no additional payment required to exercise the purchase option). This may not obligate the Government to any penalty or other obligation beyond 30 days notice of cancellation. Attach all detailed terms and conditions pertaining to this plan; all must meet the contractual requirements of the Solicitation document.

j. Applicable Months - Enter the range of contract months for which the charges for the item are applicable by indicating the first and the last contract month for the payments in the two columns provided below.

k. Price List - Indicate the page numbers in your authorized price list where the items proposed are listed. (If not under ADP Schedule Contract, attach the current commercial price list.)

SECTION J

TABLE A-1
DETAILED HARDWARE/SOFTWARE COST TABLE

[Insert Maintenance Prices in Table A-1M]

				PROCUREMENT ALTERNATIVES (WITHOUT MAINTENANCE)							
				Lease	Lease With Option to Purchase			LTOP			
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)		(k)
CLIN	Model No.	Description	Purchase Price [Required]	Monthly Lease (Rental) Payment	Monthly Lease Payment	Credits Accrued (for 12 months)	Amount Required to Exercise Purchase Option (at end of 12th month)	Lease to Ownership Amount of Balanced Monthly Payment	Applicable Contract Months		Price List
									Starting Contract Month	Ending Contract Month	

TABLE A-1M
DETAILED HARDWARE/SOFTWARE MAINTENANCE COST TABLE

INSTRUCTIONS - Below is an explanation of the items listed in Cost Table A-1M.

a. CLIN

b. Description - Enter a descriptive title of the item.

c. Quantity - Enter the number of each item proposed for each year.

d. Unit Monthly Maintenance Cost - Enter the unit monthly cost for maintenance of the proposed item for each year.

e. Total Annual Maintenance Cost - Enter the total annual cost of maintenance for the proposed items in each year. This figure should be ascertained by multiplying the Quantity times the Unit Maintenance Cost times the number of months the equipment is installed for each year.

f. Applicable Contract Months - Enter the range of contract months for which the maintenance charges for the item are applicable by indicating the first and the last contract month for the payments in the two columns provided below.

Maintenance prices will remain fixed for an entire contract year. Firm fixed prices must be quoted for the full systems life. The vendor will quote prices in one of the two following methods:

1. Firm fixed prices may be quoted for the life of the contract.

2. The vendor shall quote firm fixed prices for the first full contract year and firm fixed price increases for each year of the remaining life of the contract.

SECTION J

TABLE A-1M
DETAILED HARDWARE/SOFTWARE MAINTENANCE COST TABLE

		YEAR 1			YEAR 2				FINAL YEAR			APPLICABLE MONTHS	
CLIN	DESCRIPTION	QTY	UNIT MTHLY. MAINT. COST	TOTAL ANNUAL MAINT. COST	QTY	UNIT MTHLY. MAINT. COST	TOTAL ANNUAL MAINT. COST	...continue for additional years up to the final year of the Base Contract	QTY	UNIT MTHLY. MAINT. COST	TOTAL ANNUAL MAINT. COST	Starting Contract Month	Ending Contract Month

TABLE A-2
DETAILED ADDITIONAL ITEMS COST TABLE

INSTRUCTIONS - Any other cost chargeable to the Government and not included in any other previous cost table must be listed here. The Offeror is required to enter the costs in the appropriate years. Below is an explanation of the items to be entered in this table.

1. Site Preparation - Enter the cost for site preparation that is chargeable to the Government.

2. Transportation Costs - Enter the cost of transporting equipment to the site for installation.

3. Analyst/Support Services - Enter the labor cost for all services proposed. Breakout these service costs by labor category (e.g., hardware maintenance, software maintenance, on-site support analyst, etc.).

4. Training - Enter the cost of the proposed training.

5. Manuals - Enter the cost of the manuals.

6. Internet Service - Enter the cost of Internet Service (Section 4.6.7)

7. Other Costs - Enter any other proposed cost not included elsewhere in any cost tables. The Government will not be liable for any cost not presented.

8. Total Additional Cost - Compute the column totals and enter the sums as the total additional cost for each year.

SECTION J

COST TABLE A-2
DETAILED ADDITIONAL ITEMS COST TABLE

CLIN	ITEM	YEAR 1	YEAR 2	...additional years up to the final years of Base Contract	FINAL YEAR
	1. Site Preparation				
	2. Transportation				
	3. Analyst/Support Services				
	4. Training				
	5. Manuals				
	6. Internet Service				
	7. Other Costs (Explain)				
	8. TOTAL ADDITIONAL COST				

SECTION J

TABLE A-3.1
LEASE (RENTAL) PLAN

INSTRUCTIONS - The Offeror is required to enter all costs associated with the lease (rental) of the equipment proposed to meet the Government's requirement. Below is an explanation of the items to be entered in this table.

1. Equipment/Software Leased - Enter the cost of leasing the equipment/software throughout the contract life. Provide costs for each month for each CLIN.

2. Maintenance - Enter the cost of maintaining the equipment/software for each month, designated by CLIN.

3. Total Costs - Compute the column totals for items 1 through 3 and enter the sums as the total costs for each year.

4. Nominal Discount Factor - Enter the appropriate monthly Nominal Discount Factor from Table B.

5. Evaluated Cost - For each month, multiply the total cost by the Nominal Discount Factor to obtain the evaluated cost for that month.

6. The Total Overall Evaluated Cost for the Plan is the sum of the evaluated cost for all months of the contract life, entered in the final month of the contract.

THE TOTAL EVALUATED COST FOR THE PLAN IS THE SUM OF THE EVALUATED COSTS FOR ALL YEARS OF THE CONTRACT LIFE.

SECTION J

TABLE A-3.1
LEASE (RENTAL) PLAN

ITEM	MONTH								
	1	2	3	4	5	6	7		to Final Month of Contract
1. EQUIPMENT									
2. MAINTENANCE									
3. TOTAL COSTS									
4. NOMINAL DISCOUNT FACTOR	**SEE**	**TABLE**	**B**						
5. EVALUATED COST									
6. TOTAL OVERALL EVALUATED COST									

SECTION J

TABLE A-3.2
LEASE TO OWNERSHIP PLAN (LTOP)

INSTRUCTIONS - If a Lease to Ownership acquisition plan is proposed, the Offeror is required to enter all costs associated with the installment purchase of the equipment/software proposed to meet the Government's requirement. Below is an explanation of the items to be entered in this table.

1. Equipment/Software Leased - Enter the cost of purchasing the base equipment and software by installment on a monthly basis by CLIN.

2. Maintenance - Enter the cost of maintaining the equipment and software for each month by CLIN.

3. Total Costs - Compute the column totals for items 1 through 2 and enter the sums as the total costs for each year.

4. Nominal Discount Factor - Enter the appropriate monthly Nominal Discount Factor from Table B.

5. Evaluated Cost - For each month, multiply the total cost by the Nominal Discount Factor to obtain the evaluated cost for that month.

6. Evaluated Residual Value - The product of the Nominal Discount Factor for the final contract month times the system's residual value, which is an estimate of the price that the system could be sold for at the end of the contract life.

7. Total Overall Evaluated Cost - The sum of the evaluated cost for all months of the contract life less the Evaluated Residual Value.

THE TOTAL EVALUATED COST FOR THE PLAN IS THE SUM OF THE EVALUATED COST FOR ALL MONTHS OF THE CONTRACT LIFE LESS ITS EVALUATED RESIDUAL VALUE.

SECTION J

TABLE A-3.2
LEASE TO OWNERSHIP PLAN

CLIN	ITEM	MONTH								
		1	2	3	4	5	6	7	8	To Final Month of Contract
1.	EQUIPMENT/SOFTWARE									
2.	MAINTENANCE									
3.	TOTAL COSTS									
4.	NOMINAL DISCOUNT FACTOR	**SEE**	**TABLE**	**B**						
5.	EVALUATED COST									
6.	RESIDUAL VALUE									
7.	TOTAL OVERALL EVALUATED COST									

SECTION J

TABLE A-3.3
LEASE WITH OPTION TO PURCHASE

INSTRUCTIONS - The Offeror is required to enter all costs associated with the purchase of the equipment/software proposed to meet the Government's requirements. Below is an explanation of the items to be entered into this table.

1. Equipment/Software Leased - Enter the lease cost of all equipment/software by month and by CLIN.

2. Purchase Option Credits: Enter the total credits accrued on equipment/software.

3. Purchase Price - Enter the purchase price of equipment purchased.

4. Maintenance - Enter the cost of maintaining the equipment by month and by CLIN.

5. Total Costs - Compute the column totals for items (1.) through (4.) and enter the sums as the total costs for each month.

6. Nominal Discount Factor - Enter the appropriate monthly Nominal Discount Factor from Table B.

7. Evaluated Cost - For each month, multiply the total cost by the Nominal Discount Factor to obtain the evaluated cost for that month.

8. Evaluated Residual Value - The product of the Nominal Discount Factor for the final contract month times the system's residual value, which is an estimate of the price that the system could be sold for at the end of the contract life.

9. Total Overall Evaluated Cost - The sum of the evaluated cost for all months of the contract life less the Evaluated Residual Value.

THE TOTAL EVALUATED COST OF PURCHASING THE EQUIPMENT PROPOSED TO MEET ALL BASE REQUIREMENTS IS THE SUM OF THE EVALUATED COST FOR ALL MONTHS OF THE CONTRACT LIFE LESS THE EVALUATED RESIDUAL VALUE.

SECTION J

TABLE A-3.3
LEASE WITH OPTION TO PURCHASE

CLIN	ITEM	MONTH							
		1	2	3	4	5	6		To Final Month of Contract
1.	EQUIPMENT/ SOFTWARE								
2.	PURCHASE OPTION CREDITS								
3.	PURCHASE PRICE								
4.	MAINTENANCE								
5.	TOTAL COSTS								
6.	NOMINAL DISCOUNT FACTOR	**SEE**	**TABLE**	**B**					
7.	EVALUATED COST								
8.	EVALUATED RESIDUAL VALUE								
9.	TOTAL OVERALL EVALUATED COST								

SECTION J

TABLE A-3.4
PURCHASE PLAN

INSTRUCTIONS - If a Lease to Ownership acquisition plan is proposed, the Offeror is required to enter all costs associated with the installment purchase of the equipment/software proposed to meet the Government's requirement. Below is an explanation of the items to be entered in this table.

1. Equipment/Software Leased - Enter the cost of purchasing the base equipment and software on a monthly basis by CLIN.

2. Maintenance - Enter the cost of maintaining the equipment and software for each month by CLIN.

3. Total Costs - Compute the column totals for items 1 through 2 and enter the sums as the total costs for each month.

4. Nominal Discount Factor - Enter the appropriate monthly Nominal Discount Factor from Table B.

5. Evaluated Cost - For each month, multiply the total cost by the Nominal Discount Factor to obtain the evaluated cost for that month.

6. Evaluated Residual Value - The product of the Nominal Discount Factor for the final contract month times the system's residual value, which is an estimate of the price that the product could be sold for at the end of the contract life.

7. Total Overall Evaluated Cost - The sum of the evaluated cost for all months of the contract life less the Evaluated Residual Value.

THE TOTAL EVALUATED COST FOR THE PLAN IS THE SUM OF THE EVALUATED COST FOR ALL MONTHS OF THE CONTRACT LIFE LESS ITS EVALUATED RESIDUAL VALUE.

SECTION J

TABLE A-3.4
PURCHASE PLAN

CLIN	ITEM	MONTH								
		1	2	3	4	5	6	7	8	To Final Month of Contract
1.	EQUIPMENT/SOFTWARE									
2.	MAINTENANCE									
3.	TOTAL COSTS									
4.	NOMINAL DISCOUNT FACTOR	**SEE**	**TABLE**	**B**						
5.	EVALUATED COST									
6.	RESIDUAL VALUE									
7.	TOTAL OVERALL EVALUATED COST									

SECTION J

TABLE A-4
ADDITIONAL ITEMS COST TABLE BY MONTH

INSTRUCTIONS: The Offeror is required to provide a monthly breakout of the additional cost items listed in Table A-2.

1.- 7. Additional Cost Items as listed in Table A-2, identified by CLINs, indicating cost for each contract month.

8. Total Cost - Compute the column totals for items (1.) through (7.) and enter the sums as the total costs for each month.

9. Nominal Discount Factor - Enter the appropriate monthly Nominal Discount Factor from Table B.

10. Evaluated Cost - For each month, multiply the total cost by the Nominal Discount Factor to obtain the evaluated cost for that month.

11. Total Overall Evaluated Cost - The sum of the evaluated cost for all months of the contract life.

SECTION J

COST TABLE A-4
ADDITIONAL ITEMS COST TABLE BY MONTH

		MONTH							
CLIN	ITEM	1	2	3	4	5	6		To Final Month of Contract
	1. Site Preparation								
	2. Transportation								
	3. Analyst/Support								
	4. Training								
	5. Manuals								
	6. Internet Service								
	7. Other Costs (Explain)								
8. TOTAL ADDITIONAL COST									
9. NOMINAL DISCOUNT FACTOR		**SEE**	**TABLE**	**B**					
10. EVALUATED COST									
11. TOTAL OVERALL EVALUATED COST									

COST TABLE A-5
POWER, COOLING AND FLOOR SPACE COST TABLE

INSTRUCTIONS: The Offeror must provide estimates for power, cooling, and floor space requirements for the proposed system and an estimate of the annual cost of power to operate and cool the system. Estimates must be made for each month of the system life. Instructions for each column of the table are provided below.

1. Monthly Power for Operation - Enter the estimated power requirements for the operation of the system, in units of Kilowatt-Hours (KWH), for each month of the contract life. These power requirements should not include an estimate of the power required for cooling the system.

2. Monthly Power for Cooling - Enter the estimated power requirements for cooling the system, in units of Kilowatt-Hours (KWH), for each month of the contract life. For purposes of evaluation, this power requirement should be 50% of the Monthly Power for Operation (Item 1 above).

3. Monthly Cooling Requirement - Enter the estimated cooling requirement for the system, in KiloBTUs per Hour (KBTU/Hr), for each month of the contract life.

4. Monthly Floor Space Usage - Enter the estimated floor space required for the system, in square feet, for each month of the contract life.

5. Total Monthly Power Cost - Enter the total cost for the power required to operate and cool the system for each month in the contract life. This Monthly Total Power Cost is calculated as:

   (Monthly Power for Operation + Monthly Power for Cooling) X (Cost per KWH)

   where the Cost per KWH is assumed, for the purpose of evaluation, to be $0.075 in FY 2001, $0.07725 in FY 2002, and $0.0795 in FY 2003 to reflect a projection of current rates with an inflation rate of 3% per year.

6. Nominal Discount Factor - Enter the appropriate monthly Nominal Discount Factor from Table B.

7. Evaluated Cost - For each month, multiply the total cost by the Nominal Discount Factor to obtain the evaluated cost for that month.

8. Total Overall Evaluated Cost - The sum of the evaluated cost for all months of the contract life.

SECTION J

COST TABLE A-5
POWER, COOLING, AND FLOOR SPACE COST TABLE

ITEM	MONTH									
	1	2	3	4	5	6	7	8	9	To Final Contract Month
1. MONTHLY POWER FOR OPERATION (KWH)										
2. MONTHLY POWER FOR COOLING (KWH)										
3. MONTHLY COOLING (KBTU/HR)										
4. MONTHLY FLOOR SPACE USAGE (SQ. FT.)										
5. TOTAL MONTHLY POWER COSTS										
6. NOMINAL DISCOUNT FACTOR	**SEE**	**TABLE**	**B**							
7. EVALUATED COST										
8. TOTAL OVERALL EVALUATED COST										

TABLE B
NOMINAL DISCOUNT FACTOR

Interest Rate 5.9%

Month	Factor
1	0.99511
2	0.99024
3	0.98539
4	0.98057
5	0.97578
6	0.97100
7	0.96625
8	0.96152
9	0.95682
10	0.95214
11	0.94748
12	0.94284
13	0.93823
14	0.93364
15	0.92907
16	0.92453
17	0.92000
18	0.91550
19	0.91102
20	0.90657
21	0.90213
22	0.89772
23	0.89332
24	0.88895
25	0.88460
26	0.88028
27	0.87597
28	0.87168
29	0.86742
30	0.86317
31	0.85895
32	0.85475
33	0.85057
34	0.84641
35	0.84226
36	0.83814

Reference: OMB Circular A-94, Appendix C (Revised January 2000)
http://www.whitehouse.gov/OMB/circulars/a094/a094.html

PART IV - REPRESENTATIONS AND INSTRUCTIONS

SECTION K - REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS

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K.1 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (FAR 52.203-2) (APR 1985)

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or

factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory--

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above

_____
_____
_____

[Insert full name of person(s) in the offeror's organization responsible for determining the prices offered in the bid or proposal, and the title of his or her position in the offeror's organization];

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above;

(c) If the offeror deletes or modifies subparagraph (a)(2) above, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

K.2 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (FAR 52.203-11) (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief as of December 23, 1989 that--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of a contract resulting from this solicitation;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer, and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend this disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

K.3 TAXPAYER IDENTIFICATION (FAR 52.204-3) (OCT 1998)

(a) Definitions.

"Common parent" as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Taxpayer Identification Number (TIN)" as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors are required to submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701© and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M and implementing regulations issued by the IRS. If the resulting contract is subject to payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.903, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

[ ] TIN:_____

[ ] TIN has been applied for.

[ ] TIN is not required because:

[ ] Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

[ ] Offeror is an agency or instrumentality of a foreign government;

[ ] Offeror is an agency or instrumentality of a Federal Government.

(e) Type of Organization

[ ] Sole proprietorship;

[ ] Partnership;

[ ] Corporate entity (not tax-exempt);

[ ] Corporate entity (tax-exempt);

[ ] Government entity (Federal, State, or local);

[ ] Foreign government;

[ ] International organization per 26 CFR 1.6049-4;

[ ] Other _____ .

(f) Common Parent.

[ ] Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

[ ] Name and TIN of common parent:

Name _____

TIN _____

K.4 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (FAR 52.204-5) (MAY 1999)

(a) Definition. “Women-owned business concern," as used in this provision, means a concern that is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.]

The offeror represents that it [ ] is a women-owned business concern.

K.5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (FAR 52.209-5) (MAR 1996)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The offeror and/or any of its Principals--

(A) Are ( ) are not ( ) presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have ( ) have not ( ), within a 3-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are ( ) are not ( ) presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (A)(1)(i)(B) of this provision.

(ii) The Offeror has ( ) has not ( ), within a 3-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners, partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the offeror learns that its certification was erroneous when submitted or has become erroneous by reasons of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

K.6 PLACE OF PERFORMANCE (FAR 52.215-6) (OCT 1997)

(a) The offeror or respondent, in the performance of any contract resulting from this solicitation, [ ] intends, [ ] does not intend [*check applicable block*] to use one or more plants or facilities located at a different address from the address of the offeror or respondent as indicated in this proposal or response to request for information.

(b) If the offeror or respondent checks "intends" in paragraph (a) of this provision, it shall insert in the following spaces the required information:

Place of Performance (Street Address, City, State, County, Zip Code)	Name and Address of Owner and Operator of the Plant or Facility if Other than Offeror or Respondent
_____	_____
_____	_____
_____	_____

K.7 SMALL BUSINESS PROGRAM REPRESENTATION (FAR 52.219-1) (MAY 1999)

(a) (1) The standard industrial classification (SIC) code for this acquisition is 3571.
(2) The small business size standard is 1000 employees.
(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it [ ] is, [ ] is not a small business concern.

(2) (Complete only if offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it [ ] is, [ ] is not, a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it [ ] is, [ ] is not a women-owned small business concern.

(c) Definitions.

"Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

"Women-owned small business concern," as used in this provision, means a small business concern-

(1) Which is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice. (1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, small disadvantaged or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to sections 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall-

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

K.8 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FAR 52.222-22) (FEB 1999)

The offeror represents that--

(a) It [ ] has, [ ] has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) It [ ] has, [ ] has not filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

K.9 AFFIRMATIVE ACTION COMPLIANCE (FAR 52.222-25) (APR 1984)

The offeror represents that--

(a) It [ ] has developed and has on file, [ ] has not developed and does not have on file, at each establishment, affirmative action programs required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2), or (b) It [ ] has not previously had
contracts subject to the written affirmative action programs requirement of the rules and regulations of the Secretary of Labor.

K.10 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (FAR 52.223-13) (OCT 1996)

(a) Submission of this certification as a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section

6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

* (i) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

* (ii) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

* (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

* (iv) The facility does not fall within Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in section 19.102 of the Federal Acquisition Regulation; or

* (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

K.11 TRADE AGREEMENTS CERTIFICATE (FAR 52.225-6) (FEB 2000)

(a) The offeror hereby certifies that each end product, except those listed in paragraph (b) of this provision, is a U.S. - made, designated country, Caribbean Basin country, or NAFTA country end product, as defined in the clause of this solicitation entitled “Trade Agreements.”

(b) The offeror shall list as other end products those supplies that are not U.S. - made, designated country, Caribbean Basin country, or NAFTA country end products.

Other end products:

Line Item No.	Country of Origin
_____	_____
_____	_____
_____	_____

(List as necessary)

(c) The Government will evaluate offers in accordance with the policies and procedures of Part 25 of the Federal Acquisition Regulation. For line items subject to the Trade Agreements Act, the Government will evaluate offers of U.S.-made, designated country, Caribbean Basin country, or NAFTA country end products without regard to the restrictions of the Buy American Act or the Balance of Payments Program. The Government will consider for award only offers of U.S.-made, designated country, Caribbean Basin country, or NAFTA country end products unless the Contracting Officer determines that there are no offers for such products or that the offers for such products are insufficient to fulfill the requirements of the solicitation.

K.12 REPRESENTATION OF LIMITED RIGHTS DATA AND RESTRICTED COMPUTER SOFTWARE (FAR 52.227-15) (MAY 1999)

(a) This solicitation sets forth the work to be performed if a contract award results, and the Government's known delivery requirements for data (as defined in FAR 27.401). Any resulting contract may also provide the Government the option to order additional data under the Additional Data Requirements clause at 52.227-16 of the FAR, if included in the contract. Any data delivered under the resulting contract will be subject to the Rights in Data--General clause at 52.227-14 that is to be included in this contract. Under the latter clause, a Contractor may withhold from delivery data that qualify as limited rights data or restricted computer software, and deliver form, fit, and function data in lieu thereof. The latter clause also may be used with its Alternates II and/or III to obtain delivery of limited rights data or restricted computer software, marked with limited rights or restricted rights notices, as appropriate. In addition, use of Alternate V with this latter clause provides the Government the right to inspect such data at the Contractor's facility.

(b) As an aid in determining the Government's need to include Alternate II or Alternate III in the clause at 52.227-14, Rights in Data--General, the Offeror shall complete paragraph © of this provision to either state that none of the data qualify as limited rights data or restricted computer software, or identify, to the extent feasible, which of the data qualifies as limited rights data or restricted computer software. Any identification of limited rights data or restricted computer software in the offeror’s response is not determinative of the status of such data should a contract

be awarded to the offeror.

© The offeror has reviewed the requirements for the delivery of data or software and states (offeror check appropriate block)--

[ ] None of the data proposed for fulfilling such requirements qualifies as limited rights data or restricted computer software.

[ ] Data proposed for fulfilling such requirements qualify as limited rights data or restricted computer software and are identified as follows:

.....
.....
NOTE: 'Limited rights data' and 'Restricted computer software' are defined in the contract clause entitled 'Rights In Data--General.'

(End of provision)

K.13 CONTRACT ADMINISTRATION

Designate below the person(s) whom the Government may contact for prompt action on matters pertaining to administration of the contract.

NAME_____TITLE_____

TELEPHONE NUMBER: AREA CODE____NUMBER_____EXT___

K.14 CERTIFICATION

I hereby certify that the responses to the above Representations, Certifications and other statements are accurate and complete.

Signature: _____

Title : _____

Date : _____

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L.21 NOTICE TO OFFERORS
L.22 ALTERNATE PROPOSALS
L.23 FACILITY DRAWINGS

L.1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE
(FAR 52.252-1) (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The Offeror is cautioned that the listed provisions may include blocks that must be completed by the Offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the Offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this address:

http://www.arnet.gov/far.

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

NUMBER	DATE	TITLE
52.204-6	JUN 1999	DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER
52.214-34	APR 1991	SUBMISSION OF OFFERS IN THE ENGLISH LANGUAGE
52.214-35	APR 1991	SUBMISSION OF OFFERS IN U.S. CURRENCY
52.215-1	FEB 2000	INSTRUCTIONS TO OFFERORS-COMPETITIVE ACQUISITIONS (ALTERNATES I AND II)
52.215-16	OCT 1997	FACILITIES CAPITAL COST OF MONEY
52.222-24	FEB 1999	PREAWARD ON-SITE EQUAL OPPORTUNITY COMPLIANCE REVIEW

L.2 REGULATORY NOTICE

Offerors are advised that certain provisions and clauses identified with a Commerce Acquisition Regulation (CAR) notation for identification purposes, have not yet been incorporated into the CAR. However, all of these items are binding for this acquisition.

L.3 INQUIRIES (CAR 1352.204-71) (JUN 1987)

Inquiries and all correspondence concerning this solicitation document should be submitted in writing to the issuing office. **Questions submitted within 25 days after issuance of this solicitation shall be answered prior to the proposal due date. Any Amendments issued and all response to questions, will be posted on Acquisition Management Division's web site at http://www.rdc.noaa.gov/~amd/SOLINDEX.HTML.**

OFFERORS ARE INSTRUCTED SPECIFICALLY TO CONTACT ONLY THE PERSON CITED IN BLOCK 10 OF THE SF33 ABOUT ANY ASPECT OF THIS REQUIREMENT PRIOR TO CONTRACT AWARD.

Offerors may use the HPCS Q&A web site to contact the person cited in Block 10 of the SF33. The RFP Q&A URL is: http://www.gfdl.gov/hpcs

L.4 TYPE OF CONTRACT (FAR 52.216-1) (APR 1984)

The Government contemplates award of a fixed-price, lease contract resulting from this solicitation.

L.5 SUBMISSION OF OFFERS

(a) Markings: It is important that the outer envelope or wrapping of your offer be addressed as follows:

Offeror's return address

TO: SEE SPECIFIC ADDRESSES CITED BELOW
Solicitation No. 52-DDNR-0-90030
Closing Date: May 26, 2000
Closing Time: 3:00 PM local time

(b) HAND CARRIED OFFERS: Proposals hand carried must be delivered to the offices cited below (SEALED OFFERS ONLY). Hand carried offers must be delivered and contact must be made with the below offices by the date and time specified in this solicitation. Proposals received at the destination(s) after the date and time specified for receipt will be considered LATE and dealt with in accordance with the Late Proposals Provisions of paragraph (c)(3) of FAR 52.215-01, INSTRUCTIONS TO OFFERORS - COMPETITIVE ACQUISITION.

All proposals (offers) shall be submitted in the quantities and format specified below:

L.5.1 STANDARD FORM 33, SOLICITATION, OFFER, AND AWARD

The Standard Form 33, Solicitation, Offer, and Award, (SF 33) is being used for this solicitation. This form is used by the Government as a request for proposal and upon submission by the Offeror it becomes the Offeror's proposal. As such it is an offer which can be unilaterally accepted by the Contracting Officer and awarded on said SF 33. The offer and acceptance form the contract. Therefore, the following points must be strictly adhered to by the Offeror in submitting the proposal.

(a) The SF 33 must be executed by a representative of the Offeror authorized to commit the Offeror to contractual obligations. The authority to sign a proposal, but not an offer, subject to unilateral acceptance and award, is not sufficient authorization to sign the SF 33.

(b) UNDER NO CIRCUMSTANCES MAKE ALTERATIONS OR CHANGES TO THE SF 33 OR THE RELATED PAGES WHICH ARE A PART OF THE ENCLOSED REQUEST FOR PROPOSAL AND PROPOSAL PACKET. You are to complete those parts which require items such as prices, place of performance, etc., when such items are called for in the enclosed request for proposal. A place is provided for you to insert such information.

Three (3) originally executed (i.e., with original signatures) copies of the Standard Form of contract (SF 33) and one (1) copy of Section K fully executed shall be submitted to the following address:

Mail/UPS/FedEx Address and Hand Delivery Address
William L. Voitk, Contracting Officer U. S. Department of Commerce/NOAA Acquisition Management Division OFA611 1305 East West Highway, STA. 7604 Silver Spring, MD 20910

L.5.2 OFFEROR'S TECHNICAL PROPOSAL

The technical proposal shall be submitted in hard copies and, in addition, on ISO-9660 CDROM, formatted in Adobe portable document format (PDF). Ten (10) hard copies and one machine readable (floppy disk or CDROM) copy of the Offeror's technical proposal shall be submitted in the format prescribed in L.6.1 to the following address:

Mail Address	Hand Delivery Address/UPS/FEDEx
Brian Gross NOAA/GFDL PO Box 308 Princeton, NJ 08542-0308	Brian Gross Room 124, NOAA/GFDL U.S. Route 1, Forrestal Campus Princeton, NJ 08542-0308

Two (2) copies of the Offeror's technical proposal (hard copy only) shall be submitted in the format prescribed in L.6.1 to the following address:

Mail/UPS/FedEx Address and Hand Delivery Address
William L. Voitk, Contracting Officer U. S. Department of Commerce/NOAA Acquisition Management Division OFA611 1305 East West Highway, STA. 7604 Silver Spring, MD 20910

L.5.3 OFFEROR'S COST/PRICE PROPOSAL

The Cost/Price proposal shall be shall be submitted in hard copy and, in addition, on 3.5" floppy disk or ISO-9660 CDROM, formatted in Adobe portable document format (PDF). In addition, Offerors shall submit a separate file contained on the electronic media consisting of all Cost Proposal Tables formatted in Microsoft Excel 97. Five (5) hard copies and one machine readable (floppy disk or CDROM) copy of the Offeror's Cost/Price Proposal shall be prepared in the format described in this Section L.6.2 and Section B and submitted to the following address:

Mail Address	Hand Delivery /UPS/FedEx Address
Brian Gross NOAA/GFDL PO Box 308 Princeton, NJ 08542-0308	Brian Gross Room 124, NOAA/GFDL U.S. Route 1, Forrestal Campus Princeton, NJ 08542-0308

Three (3) hard copies and one machine readable (floppy disk or CDROM) copy of the Offeror's Cost/Price Proposal shall be submitted in the format prescribed in L.6.2 and Section B to the following address:

Mail/UPS/FedEx Address and Hand Delivery Address
William L. Voitk, Contracting Officer U. S. Department of Commerce/NOAA Acquisition Management Division OFA611 1305 East West Highway, STA. 7604 Silver Spring, MD 20910

L.5.4 PAST PERFORMANCE

The information requested in L.6 PAST PERFORMANCE shall be submitted as follows:

Five (5) copies shall be submitted to the following address:

Mail Address	Hand Delivery/UPS/FedEx Address
Brian Gross NOAA/GFDL PO Box 308 Princeton, NJ 08542-0308	Brian Gross Room 124, NOAA/GFDL U.S. Route 1, Forrestal Campus Princeton, NJ 08542-0308

Two (2) copies shall be submitted to the following address:

Mail/UPS/FedEx Address and Hand Delivery Address
William L. Voitk, Contracting Officer U. S. Department of Commerce/NOAA Acquisition Management Division OFA611 1305 East West Highway, STA. 7604 Silver Spring, MD 20910

L.5.5 SUBCONTRACTING PLAN

In accordance with FAR 52.219-9, SMALL BUSINESS SUBCONTRACTING PLAN (included in Section I.1 by reference), offerors (large business concerns only) are required to submit a Small Business Subcontracting Plan. Reference L.14, SUBCONTRACTING SUPPORT IN ACCORDANCE WITH PUBLIC LAW 95-507, and L.15, HUBZONE SUBCONTRACTING GOALS, of this Section for applicable subcontracting goals. This Plan shall be included with the initial proposal and submitted to the following address:

Mail/UPS/FedEx Address and Hand Delivery Address

William L. Voitk, Contracting Officer
U. S. Department of Commerce/NOAA
Acquisition Management Division OFA611
1305 East West Highway, STA. 7604
Silver Spring, MD 20910

L.5.6 LIVE TEST DEMONSTRATION

The Government will conduct pre-award Live Test Demonstrations (LTDs) to examine the components of the HPCS in operation. **Only those Offerors within the competitive range (See M.1.2) will be scheduled for the LTD.** An HPCS very similar to the proposed system should be used. Additional consideration will be given if the HPCS is identical to the proposed initial system.

Requirements to be met during the LTD include (but are not limited to):

1) A demonstration of the performance levels on the LSC, AC, and HSMS of the proposed system in as much detail as possible

2) A demonstration of the features of the architecture which support the extrapolation (if any) to the proposed system from the systems used in the LTD and to supply data for the RFP response

3) Verification of the data presented in the RFP response

4) Examination of the proposed interactive environment on the LSC and AC. On the LSC, after the performance data presented in the RFP response has been verified, a scripted interactive session will be run by itself and concurrently with the LSC throughput benchmark to evaluate how well the interactive resources are isolated from the batch production workload. On the AC, after the performance data presented in the RFP response has been verified, a scripted interactive session will be run by itself and concurrently with the AC throughput benchmark to evaluate how the interactive session and batch workload interact.

5) A functional demonstration of the proposed HSMS software, separate from the timed benchmark demonstration. This demonstration must show the proposed HSMS software in operation, and allow the Government to interact with the demonstration system. The proposed HSMS hardware is not required for this demonstration.

One or more written problems will be presented regarding problem escalation procedures. The Offeror will be required to explain how they would handle the problem(s) as described.

Additional information regarding the LTD may be found in section J.3, Benchmark Instructions.

LTDs will take place during a single visit to each Offeror in the Competitive Range. The Government will allocate an Offeror two consecutive days for the LTD. The LTD will begin at 9:00 AM and end no later than 5:00 PM local time on the first day . If the Offeror is unable to successfully complete the LTD on the first day, the LTD will be repeated the second day. Should an Offeror successfully complete a portion(s) of the LTD on the first day, at the Government's discretion, the Offeror may be required to complete only the remaining or unsuccessful portion(s) the second day. If any portion of the LTD is performed on the second day, it will begin at 9:00 AM local time and will terminate before 3:00 PM. If the Offeror is unable to successfully complete the LTD on the second day, the Government will not provide another opportunity to successfully complete the LTD. Failure to successfully complete the LTD may, but will not necessarily, result in disqualification of the Offeror from further consideration. Such failure may also result in downgrade of the Offeror's proposal.

L.6 PREPARATION OF PROPOSALS

Proposals shall be prepared and submitted as described below.

NOTE: The terms "statement of need", "specification", and "statement of work" used in this Section are synonymous.

L.6.1 TECHNICAL PROPOSALS

The technical proposal will be used to evaluate offerors' capabilities to provide and perform the requirements detailed in section C, the Statement of Need.

The technical proposal must be organized with sections tabbed as described below. For each tab, a numbered list of proposal instructions is given below. A specific response must be given to each numbered instruction. To keep each tab independently readable, responses of the form "Same as tab 6, instruction 7" or "Features same as LSC" are not permitted.
The technical proposal must be prepared using the Helvetica font in 10 point size for all text portions. It must be formatted to print double-sided on 8.5" by 11" paper with 1" margins on all sides. Page numbers must be printed in the bottom margin, centered, in the format "tab - page", where tab is the tab number, and page begins at 1 for each tab. The requested hardcopies must be spiral or "wiro" bound.

The technical proposal must use October 1, 2000, as the start of the HPCS system life. Upgrades must be specified as "month/year", where month is 1 to 12, and year is 2000 or larger. The user

acceptance test for each upgrade starts on the first day of the specified month (see section C.4.9.5).

The technical proposal may be up to 100 pages long (50 sheets of paper when printed). The final revision of the technical proposal must be provided as a complete document, not as change pages. In addition, a change document must be provided which highlights all deleted and added text.

TAB 1. OVERVIEW

For this tab, give responses for the base contract period only.

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given.

1. Configurations and Performance Levels. Provide a table showing the hardware configurations, performance levels, and availability levels proposed for the base contract period. The table must have columns labeled LSC, AC, and HSMS and rows labeled “month/year” (for initial delivery and each upgrade). Each cell of the table must show a hardware configuration, performance level, and availability level, or say “no change”. For the LSC and AC, hardware configuration must be limited to the numbers and types of computers, identified by manufacturer and product name. For the HSMS, hardware configuration must be limited to the HSMS hosts, the numbers and types of nearline tape drives, and the nearline storage capacity in dTB.

Performance levels must be given as follows:

LSC	LSC throughput benchmark times given for tab 6, instruction 38
AC	AC throughput benchmark times given for tab 7, instruction 39
HSMS	Archive benchmark times given for tab 8, instruction 28

2. LSC System Life Throughput. State the LSC system life throughput computed in tab 6, instruction 39.

3. AC System Life Throughput. State the AC system life throughput computed in tab 7, instruction 40.

4. HPCS System Diagram. Provide a high-level diagram of the HPCS at initial delivery and each upgrade. Each diagram must show the LSC, AC, HSMS, and HFS, with text labels giving total nodes, CPUs, memory, and disk. For the HSMS, the robotic tape library must be shown, labeled with its capacity in dTB. Each diagram must show how the LSC, AC, HSMS, and HFS are connected by the HPCS backbone network. Changes made at each upgrade must be highlighted.

5. Plan for T94. Will the Government-owned T94 be used to host the legacy archive? If so, how long will it be used for this purpose? When is de-installation of the T94 proposed? What AC upgrade at this time compensates for loss of the T94's computational performance?

6. Delayed Acceptance. In the event that the initial HPCS does not pass its acceptance test in time to replace the T932 and T3E, what equivalent computational and archival storage resources would be provided (see section C.4.1)?

TAB 2. EXCEPTIONS

A specific response must be given to each numbered instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given.

1. Exceptions. List all exceptions taken to the Government's requirements, giving the offeror's rationale for each exception.

TAB 3. OFFEROR QUALIFICATIONS

A specific response must be given to each numbered instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given.

1. Offeror Qualifications. Give a brief description of the offeror addressing the qualifications, experience, and corporate resources that allow the offeror to satisfy the Government's requirements.

TAB 4. PROJECT MANAGEMENT

A specific response must be given to each numbered instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given.

1. HPCS Management. Give a brief description of how the project is to be organized, staffed, and managed, identifying all subcontractors.

2. HPCS Personnel. State the number of software engineers, hardware engineers, and applications analysts proposed, and describe their qualifications and duties.

TAB 5. BENCHMARKS

For this tab, insert the offeror's written benchmark response, as requested by the benchmark instructions, section J.3. Include responses for the LSC Throughput Benchmark (J.3.2.2.3), the LSC Scaling Study (J.3.2.3.3), the AC Throughput Benchmark (J.3.3.2), the AC Contention-Free Performance Study (J.3.3.3), and the HSMS Benchmark (J.3.4.3).

The requested benchmark spreadsheets must be provided separate from the technical proposal. Each offeror must provide one machine-readable copy and one hardcopy of the benchmark spreadsheets.

TAB 6. LARGE SCALE CLUSTER (LSC)

For this tab, give responses for the base contract period only. Responses must be limited to the Large Scale Cluster (LSC).

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given. Each instruction response must describe the initial LSC delivery and note the changes made at each LSC upgrade. Upgrades must be specified as "month/year", where month is 1 to 12, and year is 2000 or larger.

1. Total Hardware Quantities. Give the total number of nodes, the total number of CPUs, the total memory in GB, the total disk in dTB, and total bandwidth to disk in dMB/s available to user applications. Give the total memory in GB after exercising the option for 512 MB of memory per processor. Give the total memory in GB after exercising the option for 1 GB of memory per processor.

2. Computers. Section C defines a computer to be "the maximum set of nodes that may be unavailable during the repair of any subset of those nodes." Following this definition, identify the computers in the LSC.

3. Nodes. Give the total number of nodes, and its breakdown into different node types. For nodes that run user applications, are all processors binary compatible, and do all nodes have identical hardware configurations? If not, describe the differences between the processors or nodes. What is the maximum number of nodes a single MPI message-passing application may use on the LSC?

4. Node Configuration. For each type of node, give the number of CPUs in a node, the CPU type, clock speed, and byte order (big- or little-endian), the total memory in GB on a node, the node memory per CPU, the largest logically-shared address space on a node, the number and type of I/O channels on a node, and the amount of local disk in dGB on a node. Describe how the options

for 512 MB and 1 GB of memory per processor are implemented, indicating if installed memory must be removed to perform the upgrade. Include the total memory on a node after each upgrade.

5. Node Cache Hierarchy. For nodes that run user applications, describe the cache hierarchy, including cache sizes in MB. What are the possible data paths between node memory and CPU registers? What are the hardware-level latencies and bandwidths for each part of each data path, with time given in CPU clock periods? What are the typical latencies and bandwidths when the effect of latency hiding is included?

6. Cluster Interconnection Network. Identify the products which make up the cluster interconnection network. Briefly describe the interconnection network. What are the features for data integrity checking and high availability? What is the bisection bandwidth of the proposed configuration?

7. Message Passing Within a Node. For multiple-CPU nodes that run user applications, give the latency and effective bandwidth of point-to-point and non-blocked bi-directional message passing within a node. Give values for raw message sizes of 2 bytes, 20 bytes, 200 bytes, 2 KB, 20 KB, 200 KB, and 2000 KB, or the closest available data points. The effective bandwidth b_e is defined as

$$b_e = \frac{N + N_E}{T_l + N/b}$$

where N is the raw message size, N_E is the size of the header and trailer information added to the raw message for purposes of transmission, T_l is the latency for sending the message, and b is the raw bandwidth. Describe the data paths taken and the sources of message-handling overhead. How do the available message-passing interfaces differ in performance?

8. Message Passing Between Nodes. For nodes that run user applications, give the latency and effective bandwidth (as defined in instruction 7 of this tab) of point-to-point and non-blocked bi-directional message passing within a node. Give values for raw message sizes of 2 bytes, 20 bytes, 200 bytes, 2 KB, 20 KB, 200 KB, and 2000 KB, or the closest available data points. Describe the data paths taken and the sources of message-handling overhead. How do the available message-passing interfaces differ in performance?

9. LSC disk. Identify the numbers, types, and placement of disk subsystems, channels, and channel switches which provide the LSC disk storage. What type of fault-tolerant disk subsystem is proposed? How is performance impacted by failure of a disk drive? How many concurrent, independent disk I/O operations can be performed, to handle multiple jobs and interactive users? Show a calculation of the total formatted capacity in dTB, exclusive of RAID parity disks and other system use. Show a calculation of the total sustained I/O bandwidth of the proposed configuration. If zoned disks with a varying number of sectors-per-track are used, give two calculations,

reflecting the maximum and minimum disk transfer rate.

10. LSC disk deployment. How is the proposed LSC disk storage deployed for temporary files accessed by the production workload? Identify the filesystem software used. Is this filesystem node-local or cluster-global? If cluster-global, is the filesystem accessible from all nodes that run user applications? If cluster-global, are user or group disk space quotas supported? Summarize the filesystem's features for high-performance, large-scale computing. Include the maximum filesystem size and maximum file size.

11. Operating System. Identify the operating system on the LSC nodes, and the release proposed for initial installation. Describe how node OS upgrades will be done, their duration, and their impact on LSC availability and numerical results from applications. How often will node OS upgrades be done?

12. Application Scheduling. What LSC software provides low-level launching and scheduling of message passing applications? Does the correct count of available processors ensure an application can start, or is the location of processors also a factor? For multi-processor nodes, are applications scheduled within a node when possible? Can processors be dedicated to a message-passing application? Can a message passing application be gang-scheduled? How are the scheduling features usually deployed for batch and interactive use?

13. Interactive Use. How is the LSC shared by concurrent batch and interactive use? Are there separate resources for interactive work? Is it possible to reassign interactive resources to batch use without a reboot of the LSC? Is a single hostname presented for user logins to the LSC?

14. Batch Queuing and Scheduling. Identify the software product that provides batch queuing and scheduling. Give example resources requested by a typical LSC job, and describe the conditions that must be met for this job to start execution. Characterize each condition as resource scheduling or load-balancing. Give the complete list of resources that can be managed, distinguishing scheduling from load-balancing. Give an example batch queue configuration. Describe the ways a human operator can intervene in job scheduling, using either operator or administrator (root) privileges.

15. Batch Checkpoint/Restart. Is checkpoint/restart implemented at the system or user level? If system-level, what kind of restrictions apply to jobs or programs for them to be checkpointable? If user-level, what application program changes are required? In the proposed LSC configuration, will checkpointed jobs be restartable on different nodes in the cluster? Estimate the time required to checkpoint a job which uses one-tenth of the total LSC memory.

16. Batch User Interface. Describe batch job submission. List the resource requirements, limits, and preferences that may be specified for a batch job. Can the number of processors be requested as a range, while an environment variable tells the job the number actually available at execution time? List the batch status commands. Are submitted job scripts spooled, or must the user avoid changing the job script file until the job has completed?

17. Accounting Software. Identify the software product that provides LSC accounting. If implemented via polling, give the polling interval, and the granularity of the resource usage reported. Can interactive and batch CPU time be accounted separately? Can separate projects within each group be configured and specified by the user at job submission? What monthly total accounting information can be reported for users, groups, or projects? How would a report of the monthly total LSC CPU time for each user be implemented?

18. Job Accounting. If job accounting is available, identify the software product that provides it. If implemented via polling, give the polling interval, and the granularity of the resource usage reported. What total and high-water mark resource usage information can be reported for a batch job? Can this report be inserted into the job's printed output as a "tail sheet"?

19. Resource Limits and Allocations. What job or process resource limits can be configured? What resources can be allocated to users, groups, or projects? How can monthly batch CPU time allocations for groups or projects be implemented?

20. System Activity Monitoring. Identify the software product that provides LSC system activity monitoring, and summarize the available features. How are user and system CPU utilization and I/O wait time reported?

21. Programming Environment. Identify the software products which provide the required FORTRAN 90, C, and C++ programming environments, source-level debuggers, and performance profilers. Summarize the features of these products. What macro preprocessing is provided for FORTRAN 90? What source code management facilities are available?

22. Floating-Point Implementation. Is 64-bit precision the default for FORTRAN 90 REALs? If not, how is 64-bit precision specified? By default, do division by zero, numeric overflow, and invalid numeric operations cause FORTRAN 90 programs to abort? If not, how can the user enable these interrupts? Can uninitialized variables be set to a value that causes an abort if used? Are denormalized IEEE numbers supported, or are they treated as zero or indefinite? (Denormalized numbers have the minimum exponent, and one or more leading zeroes in the mantissa.) How do C and C++ differ from FORTRAN 90 for these questions?

23. Parallel Programming Model. List the parallel programming models available on the LSC. Briefly discuss the performance considerations for each programming model.

24. I/O Programming Model. Describe the available I/O programming models. How does an application running on multiple nodes perform I/O to a single disk file? If LSC disk is not accessible from all nodes that run applications, explain the impact on application programming and scheduling. Is MPI-2 parallel I/O available or planned?

25. Hardware Performance Monitor. Is the CPU's hardware performance monitor supported by performance profiling software? If so, describe how the user produces a report of hardware performance monitor data. What information is shown by this report?

26. Data Conversion. Describe the data conversion facilities available to FORTRAN 90 programs. Are 32- and 64-bit IEEE numeric format, f77 and byte-stream record format, and big- and little-endian byte order supported? What other foreign data formats are supported?

27. Multi-file Archive. To assure that logically-related files are placed on the same tape in the HSMS, users may combine several related files into a multi-file archive using a utility such as UNIX tar or cpio. What utilities to create multi-file archives are available on the LSC? Is the format compatible between the LSC and AC? Is the format industry-standard? Can a component file be extracted without reading through the entire multi-file archive? For each utility, give the size of the disk I/O buffer used.

28. Degraded Mode. Briefly describe the capabilities for individual nodes and the cluster interconnection network to operate and be repaired in degraded mode. List all single points of failure in the LSC.

29. Failover. Describe LSC failover for batch resources. What events occur when a node being used by a batch job fails? Describe LSC failover for interactive resources. Is the software that launches and schedules message passing applications aware of node failure? After a node is repaired, what must be done to make it available for use? If live spare nodes are configured, explain how they are used. What failover is provided for the system software that controls batch queuing and scheduling?

30. Software Testing. Does the LSC feature the ability to test OS and application software upgrades in isolation from production resources? If so, describe this feature.

31. Impact of Upgrades. Describe the impact the proposed upgrades will have on the availability of the LSC. How much scheduled downtime is anticipated for upgrades? Will phased upgrades result in two or more different node configurations within the cluster?

32. Installed Base. Give the size of the installed base of the major hardware and software products proposed for the LSC.

33. Maintenance. Describe the proposed maintenance service for LSC hardware and software, identifying subcontractors and personnel. Describe the related off-site technical support resources, including hours of availability. Summarize the escalation procedures for hardware and software problems.

34. Documentation. What LSC documentation is available to customers? Is on-line documentation available over the Internet, or as a CD-ROM?

35. Training. Describe the proposed LSC training courses. What subcontractors or personnel will provide this training? When can this training be made available?

36. Pre-delivery Access. What system similar to the initial LSC will GFDL have access to between contract award and the start of acceptance? Describe this system’s configuration,

including the available disk storage and archiving facilities. What technical support resources will be available to GFDL programmers during this period?

37. Availability Levels. For the initial delivery and each upgrade, give the proposed LSC availability level, and the offeror's rationale for choosing this level. For the initial delivery, give the mean time between failure for each individual node, and show a calculation of the mean time between node failures for the entire cluster.

38. Performance Levels. For the initial system and each upgrade, give the proposed LSC throughput benchmark execution time in seconds. The times given should assume that benchmark source code changes have been implemented, and the benchmark is run on the complete offered system.

39. LSC System Life Throughput. Show a calculation of the LSC system life throughput for the base contract period. This calculation is based on actual calendar days beginning October 1, 2000. For example, if the proposed LSC throughput benchmark execution time is 10,800 seconds initially, and is upgraded to 7,200 seconds on October 1, 2001, and 98% availability is proposed throughout the base contract period, the system life throughput T is given below. Note: there are 86,400 seconds in a day.

T = (365 * 86,400 * 0.98) / 10,800 + (2 * 365 * 86,400 * 0.98) / 7,200 = 11,446.4

40. Upgrade Performance Increases. For each upgrade, what are the sources of the expected increase in performance? For each upgrade, show how the proposed performance level was calculated.

41. Upgrade Systems. For each upgrade, identify the LSC subsystems that are not available at present. For each such subsystem, summarize the development schedule and status, and identify the factors that could impact the schedule given.

TAB 7. ANALYSIS CLUSTER (AC)

For this tab, give responses for the base contract period only. Responses must be limited to the Analysis Cluster (AC).

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given. Each instruction response must describe the initial AC delivery and note the changes made at each AC upgrade. Upgrades must be specified as "month/year", where month is 1 to 12, and year is 2000 or larger.

1. Total Hardware Quantities. Give the total number of nodes, the total number of CPUs, the total memory in GB, the total disk in dTB, and total bandwidth to disk in dMB/s available to user applications.

2. Computers. Section C defines a computer to be “the maximum set of nodes that may be unavailable during the repair of any subset of those nodes.” Following this definition, identify the computers in the AC.

3. Nodes. Give the total number of nodes, and its breakdown into different node types. For nodes that run user applications, are all processors binary compatible, and do all nodes have identical hardware configurations? If not, describe the differences between the processors or nodes. What is the maximum number of nodes a single MPI message-passing application may use on the AC?

4. Node Configuration. For each type of node, give the number of CPUs in a node, the CPU type, clock speed, and byte order (big- or little-endian), the total memory in GB on a node, the node memory per CPU, the largest logically-shared address space on a node, the number and type of I/O channels on a node, and the amount of local disk in dGB on a node.

5. Node Cache Hierarchy. For nodes that run user applications, describe the cache hierarchy, including cache sizes in MB. What are the possible data paths between node memory and CPU registers? What are the hardware-level latencies and bandwidths for each part of each data path, with time given in CPU clock periods? What are the typical latencies and bandwidths when the effect of latency hiding is included?

6. Cluster Interconnection Network. Identify the products which make up the cluster interconnection network. Briefly describe the interconnection network. What are the features for data integrity checking and high availability? What is the bisection bandwidth of the proposed configuration?

7. Message Passing Within a Node. For multiple-CPU nodes that run user applications, give the latency and effective bandwidth of point-to-point and non-blocked bi-directional message passing within a node. Give values for raw message sizes of 2 bytes, 20 bytes, 200 bytes, 2 KB, 20 KB, 200 KB, and 2000 KB, or the closest available data points. The effective bandwidth b_e is defined as

$$b_e = \frac{N + N_E}{T_l + N/b}$$

where N is the raw message size, N_E is the size of the header and trailer information added to the raw message for purposes of transmission, T_l is the latency for sending the message, and b is the raw bandwidth. Describe the data paths taken and the sources of message-handling overhead. How do the available message-passing interfaces differ in performance?

8. Message Passing Between Nodes. For nodes that run user applications, give the latency and effective bandwidth (as defined in instruction 7 of this tab) of point-to-point and non-blocked bi-directional message passing within a node. Give values for raw message sizes of 2 bytes, 20 bytes, 200 bytes, 2 KB, 20 KB, 200 KB, and 2000 KB, or the closest available data points.

Describe the data paths taken and the sources of message-handling overhead. How do the available message-passing interfaces differ in performance?

9. AC disk. Identify the numbers, types, and placement of disk subsystems, channels, and channel switches which provide the AC disk storage. What type of fault-tolerant disk subsystem is proposed? How is performance impacted by failure of a disk drive? How many concurrent, independent disk I/O operations can be performed, to handle multiple jobs and interactive users? Show a calculation of the total formatted capacity in dTB, exclusive of RAID parity disks and other system use. Show a calculation of the total sustained I/O bandwidth of the proposed configuration. If zoned disks with a varying number of sectors-per-track are used, give two calculations, reflecting the maximum and minimum disk transfer rate.

10. AC disk deployment. How is the proposed AC disk storage deployed for temporary files accessed by the production workload? Identify the filesystem software used. Is this filesystem node-local or cluster-global? If cluster-global, is the filesystem accessible from all nodes that run user applications? If cluster-global, are user or group disk space quotas supported? Summarize the filesystem's features for high-performance, large-scale computing. Include the maximum filesystem size and maximum file size.

11. Operating System. Identify the operating system on the AC nodes, and the release proposed for initial installation. Describe how node OS upgrades will be done, their duration, and their impact on AC availability and numerical results from applications. How often will node OS upgrades be done?

12. Application Scheduling. What AC software provides low-level launching and scheduling of message passing applications? Does the correct count of available processors ensure an application can start, or is the location of processors also a factor? For multi-processor nodes, are applications scheduled within a node when possible? Can processors be dedicated to a message-passing application? Can a message passing application be gang-scheduled? How are the scheduling features usually deployed for batch and interactive use?

13. Interactive Use. How is the AC shared by concurrent batch and interactive use? Is a single hostname presented for user logins to the AC?

14. Batch Queuing and Scheduling. Identify the software product that provides batch queuing and scheduling. Give example resources requested by a typical AC job, and describe the conditions that must be met for this job to start execution. Characterize each condition as resource scheduling or load-balancing. Give the complete list of resources that can be managed, distinguishing scheduling from load-balancing. Give an example batch queue configuration. Describe the ways a human operator can intervene in job scheduling, using either operator or administrator (root) privileges.

15. Batch Checkpoint/Restart. Is checkpoint/restart implemented at the system or user level? If system-level, what kind of restrictions apply to jobs or programs for them to be checkpointable? If user-level, what application program changes are required? In the proposed AC configuration,

will checkpointed jobs be restartable on different nodes in the cluster? Estimate the time required to checkpoint a job which uses one-tenth of the total AC memory.

16. Batch User Interface. Describe batch job submission. List the resource requirements, limits, and preferences that may be specified for a batch job. Can the number of processors be requested as a range, while an environment variable tells the job the number actually available at execution time? List the batch status commands. Are submitted job scripts spooled, or must the user avoid changing the job script file until the job has completed?

17. Accounting Software. Identify the software product that provides AC accounting. If implemented via polling, give the polling interval, and the granularity of the resource usage reported. Can interactive and batch CPU time be accounted separately? Can separate projects within each group be configured and specified by the user at job submission? What monthly total accounting information can be reported for users, groups, or projects? How would a report of the monthly total AC CPU time for each user be implemented?

18. Job Accounting. If job accounting is available, identify the software product that provides it. If implemented via polling, give the polling interval, and the granularity of the resource usage reported. What total and high-water mark resource usage information can be reported for a batch job? Can this report be inserted into the job's printed output as a "tail sheet"?

19. Resource Limits and Allocations. What job or process resource limits can be configured? What resources can be allocated to users, groups, or projects? How can monthly batch CPU time allocations for groups or projects be implemented?

20. System Activity Monitoring. Identify the software product that provides AC system activity monitoring, and summarize the available features. How are user and system CPU utilization and I/O wait time reported?

21. Programming Environment. Identify the software products which provide the required FORTRAN 90, C, and C++ programming environments, source-level debuggers, and performance profilers. Summarize the features of these products. What macro preprocessing is provided for FORTRAN 90? What source code management facilities are available?

22. Floating-Point Implementation. Is 64-bit precision the default for FORTRAN 90 REALs? If not, how is 64-bit precision specified? By default, do division by zero, numeric overflow, and invalid numeric operations cause FORTRAN 90 programs to abort? If not, how can the user enable these interrupts? Can uninitialized variables be set to a value that causes an abort if used? Are denormalized IEEE numbers supported, or are they treated as zero or indefinite? (Denormalized numbers have the minimum exponent, and one or more leading zeroes in the mantissa.) How do C and C++ differ from FORTRAN 90 for these questions?

23. Parallel Programming Model. List the parallel programming models available on the AC. Briefly discuss the performance considerations for each programming model.

24. I/O Programming Model. Describe the available I/O programming models. How does an application running on multiple nodes perform I/O to a single disk file? If AC disk is not accessible from all nodes that run applications, explain the impact on application programming and scheduling. Is MPI-2 parallel I/O available or planned?

25. Hardware Performance Monitor. Is the CPU's hardware performance monitor supported by performance profiling software? If so, describe how the user produces a report of hardware performance monitor data. What information is shown by this report?

26. Data Conversion. Describe how applications on the AC read the file formats written by the LSC. Describe the data conversion facilities available to FORTRAN 90 programs. Are 32- and 64-bit IEEE numeric format, f77 and byte-stream record format, and big- and little-endian byte order supported? What other foreign data formats are supported?

27. Multi-file Archive. To assure that logically-related files are placed on the same tape in the HSMS, users may combine several related files into a multi-file archive using a utility such as UNIX tar or cpio. What utilities to create multi-file archives are available on the AC? Is the format compatible between the LSC and AC? Is the format industry-standard? Can a component file be extracted without reading through the entire multi-file archive? For each utility, give the size of the disk I/O buffer used.

28. X-Windows Application Software. For each of the required applications listed in section C.4.8.4, discuss its availability or porting, and give the release level that will be provided on the AC. Will NAG Iris Explorer be provided?

29. Degraded Mode. Briefly describe the capabilities for individual nodes and the cluster interconnection network to operate and be repaired in degraded mode. List all single points of failure in the AC.

30. Failover. Describe AC failover for batch resources. What events occur when a node being used by a batch job fails? Describe AC failover for interactive resources. Is the software that launches and schedules message passing applications aware of node failure? After a node is repaired, what must be done to make it available for use? If live spare nodes are configured, explain how they are used. What failover is provided for the system software that controls batch queuing and scheduling?

31. Software Testing. Does the AC feature the ability to test OS and application software upgrades in isolation from production resources? If so, describe this feature.

32. Impact of Upgrades. Describe the impact the proposed upgrades will have on the availability of the AC. How much scheduled downtime is anticipated for upgrades? Will phased upgrades result in two or more different node configurations within the cluster?

33. Installed Base. Give the size of the installed base of the major hardware and software products proposed for the AC.

34. Maintenance. Describe the proposed maintenance service for AC hardware and software, identifying subcontractors and personnel. Describe the related off-site technical support resources, including hours of availability. Summarize the escalation procedures for hardware and software problems.

35. Documentation. What AC documentation is available to customers? Is on-line documentation available over the Internet, or as a CD-ROM?

36. Training. Describe the proposed AC training courses. What subcontractors or personnel will provide this training? When can this training be made available?

37. Pre-delivery Access. What system similar to the initial AC will GFDL have access to between contract award and the start of acceptance? Describe this system's configuration, including the available disk storage and archiving facilities. What technical support resources will be available to GFDL programmers during this period?

38. Availability Levels. For the initial delivery and each upgrade, give the proposed AC availability level, and the offeror's rationale for choosing this level. For the initial delivery, give the mean time between failure for each individual node, and show a calculation of the mean time between node failures for the entire cluster.

39. Performance Levels. For the initial system and each upgrade, give the proposed AC throughput benchmark execution time in seconds. The times given should assume that benchmark source code changes have been implemented, and the benchmark is run on the complete offered system.

40. AC System Life Throughput. Show a calculation of the AC system life throughput for the base contract period. This calculation is based on actual calendar days beginning October 1, 2000. For example, if the proposed AC throughput benchmark execution time is 7,200 seconds initially, and is upgraded to 3,600 seconds on October 1, 2001, and 99% availability is proposed throughout the base contract period, the system life throughput T is given below. Note: there are 86,400 seconds in a day.

T = (365 * 86,400 * 0.99) / 7,200 + (2 * 365 * 86,400 * 0.99) / 3,600 = 21,681.0

41. Upgrade Performance Increases. For each upgrade, what are the sources of the expected increase in performance? For each upgrade, show how the proposed performance level was calculated.

42. Upgrade Systems. For each upgrade, identify the AC subsystems that are not available at present. For each such subsystem, summarize the development schedule and status, and identify the factors that could impact the schedule given.

TAB 8. HIERARCHICAL STORAGE MANAGEMENT SYSTEM (HSMS)

For this tab, give responses for the base contract period only. Responses must be limited to the Hierarchical Storage Management System (HSMS).

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given. Each instruction response must describe the initial HSMS delivery and note the changes made at each HSMS upgrade. Upgrades must be specified as “month/year”, where month is 1 to 12, and year is 2000 or larger.

1. HSMS Hosts. Identify the computers hosting the HSMS, including the failover and legacy archive functions. For each computer, give the CPU complement, memory configuration, and operating system. Are these computers dedicated to the HSMS?

2. HSMS Disk. Is disk for file caching or staging within the HSMS proposed? If so, state the quantity of disk proposed, and give the rationale for the choice of this quantity. What type of fault-tolerant disk subsystem is proposed? Describe the disk subsystem and channel configuration, and give the total bandwidth to HSMS disk. If zoned disks with a varying number of sectors-per-track are used, give the maximum and minimum total bandwidth.

3. HSMS Software. Identify the software product that provides hierarchical storage management. Why is this product a good choice for large scale, high-performance computing? What is the installed base of this product? What is the product’s interface to the host operating system (proprietary, DMAPI, or VFS/vnode)? Is the host’s native filesystem managed, or does the product function as a third-party filesystem? List the components of the HSMS software, including client software if used. Briefly describe the tape format used to store archived files.

4. HSMS Software Features. Briefly describe the capabilities of the HSMS software. If HSMS disk is proposed, describe its function (e.g., file cache or staging filesystem). Can users see the current storage residency (disk, nearline, or offline) of each file? Describe the automatic migration of files between the nearline and offline tiers, including selection criteria and the data movement performed. Is user-directed migration of files between disk, nearline, and offline residency featured? Can files be transferred directly between tape and remote destinations over a network? Can users group related files and directories created at different times on a single tape volume? Can a report of the total tape storage used by each user be generated? Are quotas on tape storage featured?

5. HSMS Tape Utilization. When archived files are deleted, areas of unused space appear on tapes. Can the unused space be recovered by packing tapes? Describe the tape packing feature. Can tape packing be done during normal production use of the HSMS? What tape fill factor is usually achieved?

6. HSMS Tape Scheduling. Describe how reading of files located on the same tape volume is optimized. Describe how the HSMS responds to a sudden, large transfer of data into /archive. Will several tape drives write out data in parallel, to prevent the disk cache or filesystem from

filling? What is the relative priority of write requests, read requests, and tape maintenance activities? Can the queue of tape read requests be prioritized by job class or user?

7. Nearline Tier Robotic Library. Identify the robotic tape library proposed for the nearline tier, and the modules present in the proposed configuration. Show a calculation of the number of storage cells available for the proposed tape volumes, based on the module capacity and the number of modules.

8. Nearline Tier Tape Drives and Volumes. Identify the types of tape drives proposed for the nearline tier. For each type of tape drive, give the number of drives proposed, the channel interface, the drive's sustained transfer rate, and the volume capacity. As discussed in section C.4.5.3, which drives are proposed for small frequently-used files, and which are proposed for large files? Show a calculation of the aggregate sustained transfer rate from tape for small frequently-used files. Show a calculation of the aggregate sustained transfer rate from tape for large files. Show a calculation of the total capacity of the nearline tier. Transfer rates and capacities must be independent of compression, at the tape blocksize used by the HSMS software.

9. Nearline Tape Positioning Rate. For the tape drives proposed for small frequently-used files in the nearline tier, describe how the HSMS software searches to archived files on a tape. Are the tape drive's fast-search features used? Show a calculation of the aggregate tape positioning rate P for small frequently-used files in the nearline tier, using the formula:

P = N * 3600 / (L + S + R), where

P = aggregate tape positioning rate, N = number of tape drives, L = load and thread time in seconds, S = median search time for proposed tape volume in seconds, based on the way the HSMS software searches to archived files, and R = median rewind time for proposed tape volume in seconds.

Secondly, show a calculation of the aggregate tape positioning rate for the drives proposed for large files in the nearline tier, using the formula above.

10. Offline Tier. What archiving technology is proposed for the offline tier? Explain why this technology was chosen, considering the emphasis on high-reliability storage for offline data. Identify the types of tape or optical disk drives proposed for the offline tier. For each type of drive, give the number of drives proposed, the channel interface, the drive's sustained transfer rate, and the volume capacity. If robotically mounted, identify the robotic library used. If separate from the nearline tier robotic library, give the number of storage cells and the rated mounts/hour. Show a calculation of the total capacity of the offline tier. Transfer rates and capacities must be independent of compression, at the blocksize used by the HSMS software.

11. User Interface on LSC and AC. How is the /archive filesystem image made available on the LSC and AC? What is the proposed high-performance file transfer interface to the LSC and AC, and how is it used? Is an interface to the HSMS software provided on the LSC and AC? If so,

summarize its features. Is information about a file's residency on disk or tape media reported? Can the queue of requests and the current activity be viewed? Is this interface provided by client software or remotely-run commands?

12. Legacy Archive. Describe the approach used to provide access to GFDL's legacy archive throughout the base contract period. If hosted by the T94, give the proposed period for use of the T94, how the T94 will be networked to the HPCS, and what personnel will perform T94 system administration. If moved to a different DMF server, describe the configuration, when the move will be done, and how long the move will take. Will legacy data be moved onto new media? Will new and legacy data be presented to the user as one /archive filesystem image? Describe your solution for reading COS-blocked files and cpio files with Cray binary headers after the T94 has been removed.

13. Failover. Describe the failover capability of the HSMS. What is the backup archive host? What software product performs system monitoring for failover? How is dual- ported access to HSMS disk, tape drives, and the robotic library implemented? Is there any performance degradation after failover? List the sequence of actions that take place during a failover. What is the time, in seconds, for failover to complete?

14. Host Reliability. For each HSMS host, describe the capabilities for operating in degraded mode and for hardware repair during degraded mode operation. State the proposed availability level of the HSMS including the effect of failover operation.

15. Robotic Library Reliability. State the reliability specifications of the proposed robotic library, both as mean tape mounts between failures, and mean time between failures at constant, full operation. What design characteristics of the proposed robotic library make it suitable for an active production environment? Describe how mechanical alignment is maintained, and how the robot compensates for variations in alignment. Describe the capabilities for operating in degraded mode, and for hardware repair during degraded mode operation. Can the HSMS remain up during library repair, blocking and queuing requests until the library is returned to operation?

16. Tape Drive and Media Reliability. For each type of tape drive, summarize the drive and cartridge design characteristics that promote reliability. For each type of tape volume, describe the placement of system-level information (tape directories) on a fully- written tape.

17. Tape Drive Repair. How can tape drive failure impact the operation of the HSMS? Describe the procedure used to take a tape drive off-line for repair, then return the drive to on-line status. What software components are involved in this procedure? Will a live spare tape drive be available for use until repairs are completed?

18. Tape Error Monitoring. Are logs of recovered tape read or write errors maintained? Can tape volumes showing a large number of recovered errors be identified? Is this a manual task for maintenance engineers, or automated within the HSMS software?

19. Data Recovery Service. For each type of tape volume, describe the proposed data recovery service for physically damaged tapes. What is the expected turnaround time for tape recovery? How is the recovered data re-integrated with the HSMS?

20. Installed Base. Give the size of the installed base of the major hardware and software products proposed for the HSMS.

21. Engineering Changes and Upgrades. Describe the proposed engineering changes and upgrades to the HSMS. How will they impact HSMS availability?

22. Maintenance. Describe the proposed maintenance service for HSMS hardware and software, identifying subcontractors and personnel. Describe the related off-site technical support resources, including hours of availability. Summarize the escalation procedures for hardware and software problems.

23. Documentation. What HSMS documentation is available to customers? Is on-line documentation available over the Internet, or as a CD-ROM?

24. Long-term Viability. What is the long-term viability of the proposed HSMS? Include anticipated support for new high-capacity tape technologies, evolving network and storage standards, and upgrades to CPU and disk performance.

25. File Creation Performance. Estimate the maximum system-wide rate for transferring large numbers of 1-megabyte files from the LSC to the HSMS, without waiting for archiving to tape to complete. What are the factors that limit this file creation rate?

26. Robotic Library Sustained Performance. For the nearline tier, how many tape mounts can be done in one hour, assuming all storage cells are filled, tape locations are random, and tapes are un-mounted immediately with no load or processing time? Compare this number to the hourly performance rating used by the library's manufacturer. For the nearline tier, explain how the robot performance balances the aggregate tape positioning rate of the drives proposed for small frequently-used files.

27. Robotic Library Mount Times. For the nearline tier, provide a diagram of the proposed robotic library showing storage cell and tape drive placement. Give the minimum time and the maximum time for moving a tape volume from a storage cell to a tape drive. What storage cell and tape drive locations do these times correspond to? Are floating tape locations supported, allowing tapes to be un-mounted to the nearest empty storage cell?

28. Performance Levels. For the initial system and each upgrade, give the proposed archive benchmark execution time in seconds. The times given should assume that the benchmark is run on the complete offered system.

29. Upgrade Systems. For each upgrade, identify the HSMS subsystems that are not available at present. For each such subsystem, summarize the development schedule and status, and identify

the factors that could impact the schedule given.

TAB 9. HOME DIRECTORY FILESYSTEM SERVER (HFS)

For this tab, give responses for the base contract period only.

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given. Each instruction response must describe the initial delivery and note the changes made at each upgrade. Upgrades must be specified as “month/year”, where month is 1 to 12, and year is 2000 or larger.

1. HFS Overview. Identify the computers and software products that implement the HFS, including the failover capability. Are these computers dedicated to the HFS? What is the installed base of these products in high-availability applications?

2. HFS disk. Identify the numbers, types, and placement of disk subsystems, channels, and channel switches which provide the HFS disk storage. What type of fault-tolerant disk subsystem is proposed? How is performance impacted by failure of a disk drive? How many concurrent, independent disk I/O operations can be performed? Show a calculation of the total formatted capacity in dTB, exclusive of RAID parity disks and other system use. Give the sustained transfer rate of the disks used. For zoned disks with a varying number of sectors-per-track, give the maximum and minimum transfer rate.

3. HFS Filesystem. Identify the filesystem software used by the HFS, and describe its performance characteristics. What are the maximum filesystem size and maximum file size?

4. Legacy Home Directories. The data now residing on /home (served by an SGI/Irix workstation), /t90 on the T94, and /t3e on the T3E must be transferred to the HFS. Describe how these transfers will be done. How long will the present /home (about 6 dGB of data) be unavailable during the transfer?

5. NFS and rcp. Confirm that NFS v.3, NFS v.2, and UNIX rcp interfaces will be available for the HFS. Is a non-volatile write cache featured, to enhance write performance from NFS v.2 clients?

6. Disk Space Quotas. Identify the software products which implement per-user and per- group disk space quotas on the HFS. Are warning messages given on the LSC and AC as the quota is approached? What command on the LSC, AC, user workstations, and the T94 will show the current disk space usage and limit? How does the administrator configure quotas?

7. Failover. Describe the HFS failover implementation. Is there any performance degradation after failover? List the sequence of actions that take place during a failover. What is the time, in seconds, for failover to complete?

8. Hardware Reliability. Describe the capabilities of the HFS for operating in degraded mode,

and for hardware repair during degraded mode operation. State the proposed availability level of the HFS including the effect of failover operation.

9. Maintenance. Describe the proposed maintenance service for HFS hardware and software, identifying subcontractors and personnel. Describe the related off-site technical support resources, including hours of availability. Summarize the escalation procedures for hardware and software problems.

10. Long-term Viability. What is the long-term viability of the proposed HFS for serving a high-performance UNIX environment? Include anticipated support for evolving network and storage standards, and upgrades to CPU and disk performance.

TAB 10. CONNECTIVITY

For this tab, give responses for the base contract period only.

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given. Each instruction response must describe the initial delivery and note the changes made at each upgrade. Upgrades must be specified as “month/year”, where month is 1 to 12, and year is 2000 or larger.

1. Connectivity to HSMS. Describe the network connections and networking protocols proposed to provide network connectivity, remote filesystem access, and file transfers between the HSMS data archive and the LSC and AC. Identify the hardware features that promote high availability and reliability. For each networking protocol, estimate the file transfer performance achievable when using that protocol.

2. Connectivity to HFS. Describe the network connections and networking protocols proposed to provide network connectivity, remote filesystem access, and file transfers between the Home Directory Filesystem Server (HFS) and the LSC and AC. Include estimates of file transfer performance, and identify features that promote high availability and reliability.

3. LSC to AC Connectivity. In the proposed configuration, what are the network connection and networking protocols available between the LSC and AC. What is the expected file transfer performance between the LSC and AC?

4. Connectivity to Legacy Archive. Describe the connectivity of the HPCS to the legacy archive. If the T94 is used to serve the legacy archive, is a HIPPI connection to the T94 proposed?

5. Connectivity to FDDI Backbone. Describe the connectivity of the HPCS to GFDL’s FDDI backbone.

6. Connectivity to Gigabit Ethernet Backbone. Describe the connectivity of the HPCS to GFDL’s Gigabit Ethernet backbone. Explain how this connectivity is maintained when one of GFDL’s two

Gigabit Ethernet interfaces fails. What is the expected performance for file transfers from the HPCS data archive to a workstation on 100-megabit Ethernet?

7. Connectivity to the Internet. Describe the proposed upgrade to GFDL's access to the Internet.

8. Maintenance. Describe the proposed maintenance service for the connectivity hardware and software described above, identifying subcontractors and personnel. Describe the related off-site technical support resources, including hours of availability. Summarize the escalation procedures for hardware and software problems.

TAB 11. AUTOMATED BACKUP

For this tab, give responses for the base contract period only.

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given. Each instruction response must describe the initial delivery and note the changes made at each upgrade. Upgrades must be specified as "month/year", where month is 1 to 12, and year is 2000 or larger.

1. Overview. Describe the proposed solution for automated backup, including history backups. Identify the software and hardware products proposed. Can the HFS /home filesystem be backed up while in use? Will a full backup of 1 dTB of data from the HFS impact the HPCS backbone network or the HSMS? How much time will be needed to do a full backup of 1 dTB of data from the HFS?

2. Backup Software. Describe the features of the backup software. Will users be able to restore /home files via a graphical interface?

3. Backup Tape Storage. If tape storage outside the HSMS is proposed, give the tape technology used, the tape's volume capacity and sustained transfer rate independent of compression, and the number of tape volumes held by the robotic library.

TAB 12. FACILITIES

For this tab, give responses for the base contract period only, unless requested to do otherwise. The responses regarding the optional contract period will be used for informational purposes only and will not be used in the award evaluation.

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given. Each instruction response must describe the initial delivery and note the changes made at each upgrade. Upgrades must be specified as "month/year", where month is 1 to 12, and year is 2000 or larger.

1. Uninterruptible Power Supplies. List the proposed uninterruptible power supplies. For each unit, list the equipment it powers.

2. Available Power. Provide a time progression, by month, of the power requirements for all of the proposed equipment and how all of the equipment, including the SGI/Cray equipment running in parallel with the new equipment, will be able to function within the constraints of the provided Computer Building substation for the base contract period. Provide an analysis of the ability of the current power equipment to maintain adequate power to the facility. If the total power requirements for the base contract period installation exceed the available capacity of the Computer Building substation, provide a description of the upgrades that you will make to the substation in order to provide the necessary electric power capacity. Considering the additional power load attributable to the cooling requirements for your equipment and the current history of usage for the entire GFDL facility, provide an analysis of the transformer capacity that will be needed by the PSE&G substation, assuming that it will only be servicing the GFDL facility beginning in calendar year 2001. Provide a best estimate of the power requirements for the Computer Room for the equipment that you are proposing to deliver for the optional contract period. Do you believe that these power requirements will demand an upgrade to the facility power infrastructure and, if so, what would you expect it to require?

3. Electric Site Preparations - Provide a description of how you plan to provide power to the equipment that will be installed during the base contract period. What additional changes, if any, do you anticipate making during the optional contract period?

4. Available Cooling. Provide a time progression, by month, of the cooling requirements for all of the proposed equipment during the base contract period. Also provide your evaluation of whether the Chilled Water Plant will be able to meet the cooling requirements for all of the equipment in the Computer Room, including the SGI/Cray equipment running in parallel with the new equipment, for the base contract period. What percentage of the year do you estimate that the plant will be able to operate using only one chiller? If the total cooling requirements for the base contract period installation exceed the available capacity of the Chilled Water Plant, provide a description of the upgrades that you will make to the facility in order to provide the necessary increased cooling capacity. What upgrades, if any, will you make to the electric power capacity to support this chiller upgrade? Provide a best estimate of the cooling requirements for the Computer Room for the equipment that you are proposing to deliver for the optional contract period. Do you believe that these cooling requirements will demand an upgrade to the facility power infrastructure and, if so, what would you expect it to require?

5. Environmental Site Preparations - Provide a description of the site preparations that you will make to the Computer Room (and possibly outside the room) in order to address the environmental requirements of the equipment to be delivered during the base contract period, including the required replacement of the air conditioning (blazer) units in the Computer Room and the design of associated chilled water piping. What additional changes, if any, do you anticipate making during the optional contract period?

6. Available Floor Space. Provide a time progression, by month, of the plan for positioning all of

the proposed equipment within the Computer Room during the base contract period, including the amount and type of floor space (raised and non-raised) to be used and the expected locations of the equipment within the room. This must take into account the space occupied by the SGI/Cray equipment prior to its removal. How do you plan to use the space occupied by the two rooms at the rear of the Computer Room? What percentage of the floor space, raised and non-raised, will the new equipment use over the life of the contract? If this percentage is substantially above 50%, what procedure would you recommend be used for any follow-on installation of equipment at the end of the contract? Provide a best estimate of the floor space requirements for the Computer Room for the equipment that you are proposing to deliver for the optional contract period.

7. Flooring Site Preparations and Equipment Installation. Describe the installation plan that you will use for delivering and installing new equipment. Include in this description the plans to be followed for staging the replacement of the older raised floor explicitly identified for replacement in Section C.4.10.5. How will you evaluate the strength of the other raised floor assemblies to determine if they require replacement?

8. Facility Renovations to Provide Rooms for Operators and Printers. Provide a detailed description, including plans, for the Operator's Control Room and User Support Room, described in Section C.4.10.6, and the associated visual monitoring systems and security controls. If you plan for the construction of this room to overlap the start of system acceptance (but with occupancy permits completed by the end of acceptance), what strategy will you take to provide necessary operator controls to manage the system prior to the completion of the renovations?

TAB 13. OPTION PERIOD

For this tab, give responses for the option period FY2004-2006 only.

A specific response must be given to each instruction below. Each instruction must be reproduced in the proposal in the Helvetica-Oblique font, directly above the response given. Each instruction response must describe the initial delivery and note the changes made at each upgrade. Upgrades must be specified as "month/year", where month is 1 to 12, and year is 2003 or larger.

1. Configurations and Performance Levels. Provide a table showing the performance levels and availability levels proposed for the option period. The table must have columns labeled LSC and AC and rows labeled "month/year" (for initial system and each upgrade). Each cell of the table must show a performance level and availability level, or say "no change". Performance levels must be given as follows:

LSC LSC throughput benchmark times given for instruction 2 below

AC AC throughput benchmark times given for instruction 5 below

2. LSC Performance Levels. For the initial system and each upgrade, give the proposed LSC throughput benchmark execution time in seconds. The times given should assume that

benchmark source code changes have been implemented, and the benchmark is run on the complete offered system.

3. LSC System Life Throughput. Show a calculation of the LSC system life throughput for the option period. This calculation is based on actual calendar days beginning October 1, 2003. For an example, see tab 6, instruction 39.

4. LSC Upgrade Performance Increases. For each upgrade, what are the sources of the expected increase in performance? For each upgrade, show how the proposed performance level was calculated.

5. AC Performance Levels. For the initial system and each upgrade, give the proposed AC throughput benchmark execution time in seconds. The times given should assume that benchmark source code changes have been implemented, and the benchmark is run on the complete offered system.

6. AC System Life Throughput. Show a calculation of the AC system life throughput for the option period. This calculation is based on actual calendar days beginning October 1, 2003. For an example, see tab 7, instruction 40.

7. AC Upgrade Performance Increases. For each upgrade, what are the sources of the expected increase in performance? For each upgrade, show how the proposed performance level was calculated.

L.6.2 COST PROPOSALS

As stated in Section B, the Government anticipates leasing the equipment during the base contract period and option period. However, the Government shall own the HSMS at the end of FY2003.

Offerors are required to provide detailed pricing proposals that include all cost elements by month (e.g., lease cost, hardware maintenance, software maintenance, on-site support, power and cooling costs, etc.). Offerors are required to submit separate pages for each contract year depicting all costs. If alternate methods of acquisition are proposed, a separate proposal for each acquisition method must be submitted. Offerors are required to submit their cost proposals in a format similar to the Tables at J.4.

The Offeror is required to include the following in its cost/price proposal:

A. Price for hardware by item. Provide separate price for the LSC, AC, HSMS, HFS, etc.

B. Price for software. Provide monthly pricing for each item of software offered. Indicate if it is leased software or purchased software.

C. A breakout by labor category of all services proposed (e.g., hardware maintenance, software maintenance, on-site applications analyst, etc.) and total price for each item. A separate breakout is required for each year of the base contract period.

D. Cost associated with requirements for power and cooling.

E. A detailed description and breakout of any other price proposed.

If proposed, cost information for each subcontractor and consultant shall be furnished in the same format and level of detail as prescribed for the prime Offeror. Additionally, the Offeror shall submit the following information:

1. A description of the items to be furnished by the subcontractor.

2. Identification of the proposed subcontractor and an explanation of why and how the proposed subcontractor was selected including the extent of competition obtained.

3. The proposed subcontract price, the Offeror's cost or price analysis thereof, and performance/delivery schedule.

4. Identification of the type of subcontract to be used.

Offerors are not required to submit certified cost or pricing data with their cost proposal. Full- and-open competition is expected which will be used to determine prices fair and reasonable. However, Offerors may be requested to provide additional information in the event prices appear over-stated or under-stated.

Offerors are required to submit cost/price proposals based upon the $67 million funding profile presented in the Project Agreement. This profile includes the price of the support services (i.e., hardware/maintenance support and on-site support personnel) for the base contract period and option period.

L.6.3 PAST PERFORMANCE

In this section, the Offeror shall describe its capabilities (and those of its subcontractors and consultants, if any), and provide its experience with at least five (5) and no more than seven (7) **relevant** contracts of a similar nature and magnitude within the past three (3) years. The Offeror shall discuss how its previous experience prepares it to undertake a contract of the scope envisioned in this solicitation. The Offeror must provide information to assist the Government in assessing its ability to perform the contract as proposed. This information must include the installed base of the hardware and software proposed for the LSC, AC, HSMS, and HFS.

The “Performance Evaluation Report” contained in Section J.2 of this solicitation will be used by the Government to collect this information. References other than those identified by the Offeror

may be contacted by the Government with the information received used in evaluating the Offeror's past performance. The following information is required from all contracts cited as evidence of past performance:

Procurement activity and address

Procuring Contracting Officer's name, telephone number and address

Technical Point of Contact's name, telephone number and address

Contract No.

Type of contract

Award price

Final price

The Technical Point of Contact must possess specialized technical knowledge of the high-performance computing components covered under the respective contract.

L.7 COST REALISM

An offer is presumed to represent an Offeror's best efforts to respond to the solicitation. Any inconsistency, whether real or apparent, between promised performance and cost or price, should be explained in the proposal. For example, if the intended use of new and innovative production techniques is the basis for an abnormally low estimate, the nature of these techniques and their impact on cost/price should be explained; or, if a business policy decision has been made to absorb a portion of the estimated cost, that should be stated in the proposal. Any significant inconsistency, if unexplained, may raise a fundamental issue of understanding of the nature and scope of the work required and of the Offeror's financial ability to perform the contract, and may be grounds for rejection of the offer. The burden of proof as to cost credibility rests with the Offeror.

L.8 SITE VISIT

1. Offerors may inspect the site where the HPCS is to be installed and to satisfy themselves regarding all general and local conditions that may affect the cost of contract performance, to the extent that the information is reasonably obtainable. In no event shall failure to inspect the site constitute grounds for a claim after contract award.

2. A site visit is scheduled for April 11, 2000 commencing at 9:00AM EST. A maximum of two representatives per offeror will be admitted to the site. If you are interested in

attending the site visit, you must notify the Contracting Officer in writing at the following address:

William L. Voitk, Contracting Officer

U. S. Department of Commerce/NOAA

Acquisition Management Division OFA611

1305 East West Highway, STA. 7604

Silver Spring, MD 20910

FAX Number: (301) 713-0806

E-mail to the following address: william.voitk@agf.noaa.gov

L.9 PRE-AWARD SURVEY

The Government reserves the right for a survey team to visit the Offeror's facility(s) for the purpose of determining the technical and financial ability to perform. A current financial statement and other data pertinent to this purpose should be available at the time the team makes the visit. The team will also consider the technical and financial ability of proposed subcontractors. Examples of the type of technical, financial and other capability matters the team will-evaluate are (1) past experience with firm, (2) financial strength, (3) facilities, (4) ability to meet required delivery schedule, (5) subcontracting, (6) manpower availability and labor relations, (7) management controls and (8) any other areas pertinent to this offer.

L.10 ACCEPTANCE OF PROPOSALS

The Government reserves the right:

1. To consider as acceptable only those proposals submitted in accordance with all technical requirements set forth or referenced in this solicitation and which demonstrate an understanding of the problems involved and the scope of the project.

2. To reject, as unacceptable, proposals deleting or altering technical requirements which are considered by the Government not to be beyond the state of the art nor impossible to attain.

L.11 UNACCEPTABLE OFFER TRANSMISSION METHODS

Neither telegraphic (including mailgrams), telefax, nor e-mail offers are authorized.

L.12 AMENDMENTS TO PROPOSALS

Any changes to a proposal made by the Offeror after its initial submittal shall be accomplished by replacement pages. Changes from the original page shall be indicated on the outside margin by vertical lines adjacent to the change. The Offeror shall include the date of the amendment on the lower right corner of the changed pages.

L.13 FINAL PROPOSAL REVISION

Upon completion of negotiations, all Offerors still within the competitive range will be requested to submit a final proposal revision. Following evaluation of final proposal revisions, the Offeror whose proposal is most advantageous to the Government, considering the evaluation factors specified in Section M, will be selected for contract award.

L.14 SUBCONTRACTING SUPPORT IN ACCORDANCE WITH PUBLIC LAW 95-507

(a) Small and small disadvantaged businesses are encouraged to participate as prime contractors or as members of joint ventures with other small businesses. All interested contractors are reminded that the successful contractor will be expected to place subcontracts to the maximum practicable extent with small and small disadvantaged firms in accordance with the provisions of Public Law 95-507 and Subpart 19.7 of the Federal Acquisition Regulation.

(b) The proposed FY2000 NOAA Preference Program Goals are the following:

1. Subcontracts to small business firms ---- 52.0%

2. Subcontracts to minority-owned firms ---- 12.0%

3. Subcontracts to women-owned businesses --- 8.0%

These goals are considered to be minimum goals for NOAA's subcontracts not ceiling goals or maximum goals.

L.15 HUBZONE SUBCONTRACTING GOALS

(A) The Historically Underutilized Business Zones (HUBZones) Act of 1997 created the HUBZone Program. The purpose of this program is to provide federal contracting assistance for qualified small business concerns located in historically underutilized business zones in an effort to increase employment opportunities, investments, and economic development in these areas.

Only those contractors listed on the Small Business Administration's PRO-Net site (http://www.sba.gov) at the time of contract award are qualified HUBZone contractors and can be considered by contractors in meeting their HUBZone small business subcontracting goals.

(B) The HUBZone goals established for the Department of Commerce are as follows:

1. FY2000 - 1.5% of the total value of the prime contract
2. FY2001 - 2.0% of the total value of the prime contract
3. FY2002 - 2.5% of the total value of the prime contract
4. FY2003 and subsequent years - 3.0% of the total value of the prime contract

L.16 INCURRING COSTS

The Government is not liable for any costs incurred by Offerors in submitting offers in response to this solicitation. Proposal costs may be included in an Offeror's G&A or overhead rates as appropriate.

L.17 SERVICE OF PROTEST (FAR 52.233-2) (AUG 1996)

(a) Protests, as defined in 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO) shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from:

William L. Voitk, Contracting Officer

U. S. Department of Commerce/NOAA

Acquisition Management Division OFA611

1305 East West Highway, STA. 7604

Silver Spring, MD 20910

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

L.18 ADDITIONAL REQUIREMENTS FOR SERVICE OF PROTEST

In addition to the above, protests shall also be served on the Contract Law Division of the Office of the Assistant General Counsel for Finance and Litigation located at:

U.S. Department of Commerce

Contract Law Division

Office of the General Counsel

Herbert C. Hoover Building, Room H5893

14th Street, N.W.and Constitution Avenue, N.W.

Washington, D.C. 20230

ATTN: Jerry Walz

FAX (202) 482-5858

L.19 DEPARTMENT OF COMMERCE AGENCY-LEVEL PROTEST PROCEDURES

LEVEL ABOVE THE CONTRACTING OFFICER

On October 25, 1995, President Clinton signed Executive Order No. 12979 which directs heads of executive agencies to develop administrative procedures for resolving protests to awards of procurement contracts within their agencies at a level above the contracting officer.

The Department's goal is to encourage protesters to resolve their protests at the agency level, help build confidence in the Government's acquisition system, and reduce protests to the General Accounting Office and other external fora. Prior to submission of an agency protest, all parties shall use their best efforts to resolve concerns raised by an interested party at the contracting officer level through open and frank discussions. If concerns cannot be resolved, protesters may use these procedures when a resolution is requested from the agency at a level above the contracting officer. Vendors may obtain a copy of these through the Internet by accessing the Department of Commerce, Office of Acquisition Management's Home-page address as follows:

http://www.rdc.noaa.gov/~amd

In the event a vendor does not have access to the Internet, please contact the applicable procurement office for a hard copy of the agency level protest procedures.

Protests must be marked ?Agency Level Protest" and addressed to the ?Protest Decision Authority" indicated below:

William L. Voitk, Contracting Officer U. S. Department of Commerce/NOAA Acquisition Management Division OFA611 1305 East West Highway, STA. 7604 Silver Spring, MD 20910

The protester shall also provide a copy of the protest within 1 day to the responsible contracting officer and a copy to the addressee indicated below:

Contract Law Division Office of the Assistant General Counsel for Finance and Litigation Department of Commerce, Room H5882 14th Street and Constitution Avenue, N.W. Washington, D.C. 20230 (FAX Number 202-482-5858)

L.20 INVITATION TO PROPOSE FINANCING TERMS (FAR 52.232-31)(OCT 1995)

(a) The offeror is invited to propose terms under which the Government shall make contract financing payments during contract performance. The financing terms proposed by the offeror shall be a factor in the evaluation of the offeror's proposal. The financing terms of the successful offeror and the clause, Terms for Financing of Purchases of Commercial Items, at FAR 52.232-29, shall be incorporated in any resulting contract.

(b) The offeror agrees that in the event of any conflict between the terms proposed by the offeror

and the terms in the clause at Terms for Financing of Purchases of Commercial Items, at FAR 52.232-29, the terms of the clause at 52.232-29 shall govern.

© Because of statutory limitations (10 U.S.C. 2307(f) and 41 U.S.C. 255(f)), the offeror's proposed financing shall not be accepted if it does not conform to the following limitations:

(1) Delivery payments shall be made only for supplies delivered and accepted, or services rendered and accepted in accordance with the payment terms of this contract:

(2) Contract financing payments shall not exceed 15 percent of the contract price in advance of any performance of work under the contract;

(3) The terms and conditions of the contract financing must be appropriate and customary in the commercial marketplace; and

(4) The terms and conditions of the contract financing must be in the best interest of the United States.

(d) The offeror's proposal of financing terms shall include the following:

(1) The proposed contractual language describing the contract financing (see FAR 32.202-2 for appropriate definitions of types of payments); and

(2) A listing of the earliest date and greatest amount at which each contract financing payment may be payable and the amount of each delivery payment. Any resulting contract shall provide that no contract financing payment shall be made at any earlier date or in a greater amount than shown in the offeror's listing.

(e) The offeror's proposed prices and financing terms shall be evaluated to determine the cost to the United States of the proposal using the interest rate and delivery scheduled specified elsewhere in this solicitation.

L.21 NOTICE TO OFFERORS

This Solicitation is issued pursuant to a U.S. Department of Commerce Concept of Operations (CONOPS) Project Agreement. The full text of the Project Agreement for this acquisition is located at the following web site: http://www.gfdl.gov/hpcs

L.22 ALTERNATE PROPOSALS

Offerors may submit more than one proposal, so long as at least one proposal satisfies all of the mandatory requirement of the solicitation. As a minimum, one of the proposals submitted must be complete. The alternate proposal(s) may be in an abbreviated form following the same section format, but providing only those sections which differ in any way from those contained in the original proposal. Each proposal will include cost tables indicating the complete range of

pricing options. In the case of price/cost options for a given configuration, an alternate proposal will not be required. If alternate proposals are submitted, such alternatives will be clearly labeled and identified on the cover page of each separate document. The reason for each alternate and its comparative benefits shall be explained. Each proposal submitted will be evaluated on its own merits. Alternate proposals may be no more than 100 pages in length.

L.23 FACILITY DRAWINGS

The Government will provide Offerors with a full hardcopy set of drawings of the Computer Building at the Site Visit. If Offerors wish to receive these drawings prior to the site visit, they should notify the Contracting Officer along with (1) a FedEx (or similar) account to be charged and (2) an address where the drawings are to be sent.

M. EVALUATION FACTORS FOR AWARD

M.1. GENERAL EVALUATION INFORMATION

Careful, full, and impartial consideration will be given to offers received pursuant to this solicitation. Only Offerors which demonstrate acceptable submission to the Government of all items included in Section L of this solicitation (or amendments thereof) will be considered for award. This includes:

- Submitting a proposal that meets all minimum requirements.
- Submitting a proposal that complies with all requirements of law, regulation, and conditions set forth in the solicitation.
- Submitting a proposal that meets all technical requirements and specifications of the solicitation.

In evaluating all areas of an Offeror's proposal, the Government may consider risk. Risk may affect the Summary Rating of the Technical and Past Performance proposals.

M.1.1. Minimum Requirements

Proposals that fail to meet any of the Requirements cited in Section C.4.2 will be considered unacceptable.

M.1.2. Competitive Range

The Contracting Officer will make the determination as to which offers are in the “Competitive Range.” The Competitive Range shall be comprised of all of the most highly-rated proposals unless the range is further reduced for purposes of efficiency pursuant to FAR 15.306(c)(2). All Offerors in the competitive range will be invited to participate in the live test demonstration (LTD). The initial number of offers considered as being within the competitive range may be reduced when, as a result of the written or oral discussions, or LTD, an offer has been determined to no longer have a reasonable chance of being selected for award.

M.1.3. Discussion/ Final Proposal Revision

All Offerors selected to participate in discussions will be advised of deficiencies, serious weaknesses, and other aspects whose remedying might materially enhance their proposal, as well as negative comments concerning past performance. Offerors will be presented a reasonable opportunity to revise the price and technical parts of their proposal accordingly and to address unfavorable reports of past performance. A final common cut-

off date which allows a reasonable opportunity for submission of written responses to discussion issues shall be established, and those Offerors remaining in the competitive range will be notified to submit a final proposal revision.

M.1.4. Responsibility

An Offeror must be determined responsible according to the standards in FAR Subpart 9.1, RESPONSIBLE PROSPECTIVE CONTRACTORS

M.1.5. Evaluation of Options

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the price for the 512MB/processor option for the base contract period (FY2000-2003) to the total price for the basic requirement for the entire period covered under the Project Agreement (FY2000-2006). Evaluation of options will not obligate the Government to exercise option(s).

The performance levels offered on the LSC and AC will be the only factors used in the Technical Evaluation to evaluate the solution proposed for the option period. However, in constructing proposals, Offerors must assume that balance among the LSC, AC, HSMS, and HFS will be retained within the confines of the funding profile. Therefore, Offerors must propose a distribution of costs among the LSC, AC, HSMS and HFS.

M.2. EVALUATION OF PROPOSALS

To be acceptable and eligible for evaluation, proposals must be prepared in accordance with, and comply with, the instructions given in this solicitation document and must meet the specifications and requirements set forth in Section C. Proposals meeting the minimum requirements and complying with the provisions of the Standard Form of Contract will be evaluated in accordance with the procedures described herein and award made to the responsible Offeror whose proposal is determined to be the most advantageous to the Government.

All proposals will be evaluated based on the technical, past performance, and price factors described in this section. Proposals will be evaluated with a view toward the award of a contract presenting the most favorable offer to the Government, therefore, proposals must contain such information as may be required to conduct a detailed and thorough evaluation.

The Offeror's proposal must give clear, detailed information sufficient to enable evaluation based on the major factors and subfactors listed below.

Major factors considered in the evaluation of offers are as follows:

- **Technical** - This factor will receive a rating along with a narrative description. **For all Offerors in the competitive range, the Live Test Demonstration will affect the rating of this factor.**
- **Past Performance** - The Offeror's proposal will receive a rating based on documented information regarding such factors as quality, timeliness, customer satisfaction, personnel, cost control and business practices that the Offeror has demonstrated on projects of a similar nature in the past.
- **Price** - The price proposal will be evaluated for magnitude and realism. Price factors will also be used as a further indication of Offerors' understanding of the scope of the requirement. Life Cycle Costs will be evaluated.

M.2.1. Basis for Award

The contract awarded as a result of this Request for Proposals (RFP) will be an integrated assessment by the Contracting Officer of the results of the evaluation based on the evaluation factors and their relative order of importance as indicated below.

Ultimately, the source selection decision will take into account the Contractor's capability to meet the requirements of this solicitation on a timely and cost-effective basis. The Government reserves such right of flexibility in making the source selection to assure placement of a contract in the Government's best interest in accordance with the evaluation criteria.

Accordingly, the Government may award any resulting contract to other than the lowest-priced Offeror, or other than the Offeror with the highest technical merit rating.

M.2.2. Degree of Relative Importance Assigned to Major Evaluation Factors and Subfactors

The Technical factor will be weighted significantly more than Past Performance. The combination of the Technical factor and Past Performance will be paramount with respect to Price.

Only the configuration proposed for the $34.185 million funding level stated in this solicitation will be evaluated for technical merit, past performance, and cost/ price. However, the LSC and AC performance proposed for the option period will be evaluated for technical merit. As discussed in section C.2, it is expected that any additional funds will be used to increase the HPCS computational throughput and other resources needed to provide a balanced system approximately in proportion to the increase in funding.

M.3. TECHNICAL

The following categories will be used to evaluate the technical proposals. They are of roughly equal importance.

- LSC
- AC
- HSMS
- System-wide components

M.3.1 LSC

Factors used to evaluate the LSC are, in order of decreasing importance,

- Performance
- Reliability, Availability, and Support
- Ease of Use
- Capacity

Items used to evaluate Performance may include, but are not limited to, the System Life Throughput offered on the initial system, the LSC throughput benchmark performance in integer seconds offered on the initial system, the results of the benchmark scaling study, and the performance increment offered on upgrades during the base contract period.

Items used to evaluate Reliability, Availability, and Support may include, but are not limited to, the availability level offered in the initial system, the capability of the failover hardware and software, the available features in the resource management, batch queuing and scheduling, load balancing, and checkpointing software, the capability to operate and be repaired in degraded mode, and offered training.

Items used to evaluate Ease of Use may include, but are not limited to, the completeness and usability of the offered OS and programming environment, the available features in the resource management, accounting, batch queuing and scheduling, and checkpointing software, and the consistency of software common to the LSC and AC.

Items used to evaluate Capacity may include, but are not limited to, the memory per processor, the disk space per node, the total memory and disk, the bandwidth of the node interconnect, and the capacity of the interactive resources.

M.3.2. AC

Factors used to evaluate the AC are, in order of decreasing importance:

- Reliability, Availability, and Support
- Performance
- Ease of Use
- Capacity

Items used to evaluate Reliability, Availability, and Support may include, but are not limited to, the availability level offered on the initial system, the capability of the failover hardware and software, the available features in the resource management and checkpointing software, capabilities for operation and repair in degraded mode, and offered training.

Items used to evaluate Performance may include, but are not limited to, the System Life Throughput in total number of suites offered on the initial system, the AC throughput benchmark performance in integer seconds offered on the initial system, the performance of individual codes on the AC, and the performance of interactive commands issued during the pre-award LTD.

Items used to evaluate Ease of Use may include, but are not limited to, the completeness and usability of the offered OS and programming environment, the available features in the resource management, accounting, batch queuing and scheduling, and checkpointing software, the features available in the user and operator interface, and the consistency of software common to the LSC and AC.

Items used to evaluate Capacity may include, but are not limited to, the memory per processor and maximum memory per processor, the shared memory per node, the size of the shared address space, the disk per node, and the total disk.

M.3.3 HSMS

Factors used to evaluate the HSMS are, in order of decreasing importance:

- Reliability, Availability, and Support
- Performance
- Capacity
- Ease of Use

Items used to evaluate Reliability, Availability, and Support may include, but are not limited to, the capability of the failover software, capabilities for operation and repair in degraded

mode, the reliability of the robotic tape library, the reliability of the nearline and offline media, and the offered data recovery service.

Items used to evaluate Performance include, but are not limited to, the archive benchmark performance, aggregate sustained transfer rate of individual devices, aggregate tape positioning rate for nearline tapes, the robotic tape library performance, the performance of the user and operator interfaces to the data migration software, and the performance of file transfers to the LSC and AC.

Items used to evaluate Capacity of the HSMS include, but are not limited to, the capacity of the nearline and offline tiers in the data archive, the number of individual devices, and total bandwidth between nearline and online tiers in the HSMS.

Items used to evaluate Ease of Use include, but are not limited to, the functionality and usability of the user and operator interfaces to the data migration software, including the ability to send files from tape directly to different destinations over the network and for users to group related files and directories on a single tape volume, and the plan for accessing the legacy archive.

M.3.4 System-wide components

Factors used to evaluate the system-wide components are, in order of decreasing importance:

- Balanced performance and capacity between the HPCS subsystems
- HFS implementation
- Vendor Services
- Facilities

As discussed in section C.2, balance implies that the capacity and performance of the LSC, AC, HSMS, HFS, and their interconnection allows efficient use of HPCS resources, in part by minimizing bottlenecks to the flow of information (as represented by the benchmarks) between the components of the HPCS throughout its life. The subfactors used to evaluate balance may include, but are not limited to, the individual capacities of the HPCS components, the bandwidth between HPCS components, and the cluster software used to manage the various resources of the HPCS.

Items used to evaluate the HFS may include, but are not limited to, the HFS benchmark performance, the proposed availability level of the HFS, and the /home directory migration plan.

Items used to evaluate Vendor Services may include, but are not limited to, the quality of the Offeror's maintenance plan and failure escalation procedure.

Items used to evaluate the required Facilities include, but are not limited to, the amount of electrical power, cooling capacity, and floor space required to operate the initial delivery of the HPCS and all offered upgrades, and the impact that facilities modifications required for the initial installation and all upgrades may have on the performance or availability of the Government's existing equipment.

M.4. PAST PERFORMANCE

This factor will be rated based on the information and opinions gained by contacting the references listed in the proposal, firms with which the Offeror has a history of past performance, and possibly other customers known to the Government and others who may have useful and relevant information. The Government reserves the right not to contact all references provided and to contact other references even though not provided by the Offeror.

The following subfactors will be considered (all subfactors are of equal importance):

- Quality of products or service, compliance with contract requirements, accuracy of reports and technical excellence.
- Timeliness of performance and reliability.
- Cost control, remaining within budget, current accurate and complete billing, relationship of negotiated costs to actuals and being cost efficient.
- Satisfaction of customer end users with the contractor's service.
- Business relations, management, an effective subcontracting program, reasonable and effective contractor-recommended solutions.

Assessment of the Offeror's past performance will be one means of evaluating the credibility of the Offeror's proposal, and relative capability to meet performance requirements.

Information will also be considered regarding any significant subcontractors.

Evaluation of past performance will include a determination of the Offeror's commitment to customer satisfaction and will include conclusions of informed judgment. The basis for the past performance rating will be documented.

During discussions Offerors will be given an opportunity to address unfavorable reports of past performance, if the Offeror has not had a previous opportunity to review the rating. Recent contracts will be examined to ensure that corrective measures have been implemented. Prompt corrective action in isolated instances may not outweigh overall negative trends.

If an Offeror does not have a past performance history relating to this solicitation, the Offeror will not be evaluated favorably or unfavorably on this factor.

M.5. Price

The price proposal will be evaluated for magnitude and realism, but will not be numerically scored. To be considered acceptable under this solicitation, the Offeror must propose fixed prices for the items being acquired.

M.6. EVALUATION FACTORS

All Technical and Past Performance portions of proposals will be evaluated using the criteria listed in Table 1 below. Each Offeror will be assigned a Summary Rating for its Technical and Past Performance, determined through evaluation of its proposal.

Table 1. Evaluation Criteria

ADJECTIVE RATING	DESCRIPTION
Unacceptable	PROPOSED APPROACH HAS MANY DEFICIENCIES OR PROPOSED APPROACH IS TOTALLY WITHOUT MERIT. PAST PERFORMANCE UNACCEPTABLE.
Inadequate	PROPOSED APPROACH HAS ONE OR MORE DEFICIENCIES OR MAJOR WEAKNESSES, AND IS NOT CAPABLE OF IMPROVEMENT TO ACCEPTABLE OR BETTER WITHOUT ADOPTION OF A NEW APPROACH. PAST PERFORMANCE MORE NEGATIVE THAN POSITIVE.
Marginal	PROPOSED APPROACH HAS DEFICIENCIES OR SIGNIFICANT WEAKNESSES, BUT IS CAPABLE OF IMPROVEMENT TO ACCEPTABLE OR BETTER WITHOUT ADOPTION OF A NEW APPROACH. NO OR NEUTRAL PAST PERFORMANCE.

ADJECTIVE RATING	DESCRIPTION
Acceptable	PROPOSED APPROACH FULLY MEETS THE REQUIREMENT WITH NO DEFICIENCY OR SIGNIFICANT WEAKNESS. PAST PERFORMANCE MORE POSITIVE THAN NEGATIVE.
Good	PROPOSED APPROACH FULLY MEETS REQUIREMENT AND HAS SOME SUPERIOR FEATURES WITH NO DEFICIENCY OR SIGNIFICANT WEAKNESS. PAST PERFORMANCE ACCEPTABLE IN ALL AREAS/SUPERIOR IN SEVERAL AREAS.
Outstanding	PROPOSED APPROACH FULLY MEETS REQUIREMENT AND IS SUPERIOR IN MANY FEATURES WITH NO DEFICIENCY OR WEAKNESS. PAST PERFORMANCE ACCEPTABLE IN ALL AREAS/SUPERIOR IN MOST AREAS.